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AND MISSILE COMMAND

# **TITLE Aviation Turbine Engine Diagnostic System (ATEDS) for the OH-58D Helicopter**

**AUTHOR** Larry R. DeMott

**COMPANY NAME** Rolls-Royce Allison  
**COMPANY ADDRESS** P.O. Box 420  
Indianapolis, IN 46206

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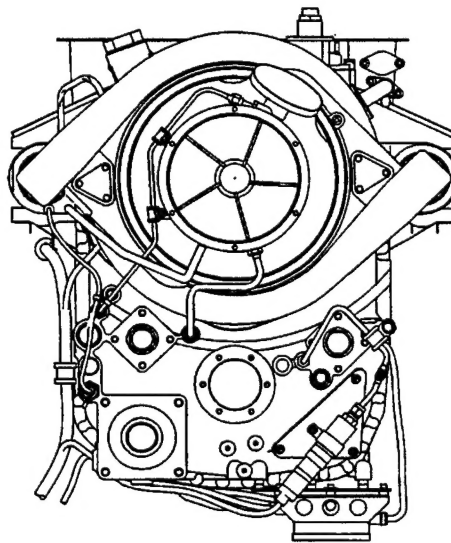
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**Technical Report No.: EDR 18882**

**Development and SGML-Tagging  
of  
Troubleshooting and Diagnostic  
Procedures  
for  
Rolls-Royce Allison  
T703-AD-700 and 250-C30R/3 Engines,  
and 250-C30R/3 FADEC**



**U.S. Army Contract DAAJ02-97-C-0014**

**Aviation Turbine Engine Diagnostic System (ATEDS)**

**19 July 1999**

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## 1.0 Foreword

The U.S. Army is currently using old test equipment and incomplete troubleshooting procedures to diagnose engine and engine-to-airframe faults on OH-58D Kiowa helicopters. Mechanics often replace numerous components, without adequate troubleshooting, until the fault is corrected. The practice is expensive, creates a burden on the logistics system, and adversely affects aircraft readiness.

The U.S. Army Aviation Center has documented the need for improved equipment and procedures to provide electronic troubleshooting/diagnostics of helicopter turbine engines, and has initiated development of an Aviation Turbine Engine Diagnostic System (ATEDS) to address this situation. ATEDS will be comprised of portable computers containing interactive software for troubleshooting and diagnosing engine and engine-to-aircraft interface problems, with links to electronic technical manuals (and, eventually, to flight data recorders and automated log books), and specialized test equipment to support the troubleshooting/diagnostic procedures.

As part of the effort to develop the ATEDS, Rolls-Royce Allison was awarded a contract (DAAJ02-97-C-0014) to generate the detailed, step-by-step, troubleshooting/diagnostic procedures and identify the specialized test equipment necessary to allow the maintainer to perform the troubleshooting/diagnostics procedures. This report addresses activities related to this system.

## 2.0 Objectives

The objectives of the contracted effort to which this report is directed are as defined under Tasks I and II of the Statement of Work, as follows.

### 2.1 Task I

The contractor shall develop the electronic Standard Generalized Markup Language (SGML) tagged datafiles of troubleshooting/diagnostic procedures for engine and engine-to-airframe interface faults (mechanical and electrical). Engine-to-airframe interface shall refer the maintainer to the procedures and appropriate manual necessary to simulate engine input/outputs to verify operation of airframe instrumentation and the procedures to verify proper engine-to-airframe mechanical/electrical interfaces. The troubleshooting/diagnostic procedures shall be limited to Aviation Unit Maintenance (AVUM) and Aviation Unit Intermediate Maintenance (AVIM) repairs. The procedures shall meet the performance requirements in Appendix A, and cover the following engines and associated airframes.

<u>Engine</u>	<u>Airframe</u>
250-C30R/3	OH-58D
T703-AD-700	OH-58D

### 2.2 Task II

The contractor shall attend a kickoff meeting at the Aviation Applied Technology Directorate, Fort Eustis, Virginia. The purpose of the meeting is to define a common user interface, among the Army's engine manufacturers, for the electronic troubleshooting/diagnostic procedures. The kickoff meeting shall be held within 30 days after contract award.

### 3.0 Scope

This report is submitted in fulfillment of requirements of Aviation Turbine Engine Diagnostic System (ATEDS) Contract DAAJ02-97-C-0014, CDRL Items A003, *Technical Report (Draft)*, and A004, *Technical Report (Final)*.

### 4.0 Summary

Troubleshooting/diagnostic procedures were developed for a total of 159 observed or indicated faults, in the following three categories:

- T703-AD-700 engine
- 250-C30R/3 basic engine (less control system)
- 250-C30R/3 Full Authority Digital Electronic Control System (FADEC)

Each troubleshooting/diagnostic procedure was developed in flow chart format and graphically depicted using Visio 4.0 software. SGML tagging was based on text and logic contained in the Visio flow charts.

The various actions to be performed on the engine and airframe in pursuance of the troubleshooting/diagnostic procedures were, where available, referenced to the corresponding tasks in the engine and/or airframe technical manuals.

Items of specialized test equipment required to perform the various diagnostic procedures were identified.

### 5.0 Recommendation

It is recommended that this report be accepted as fulfilling the requirements of Aviation Turbine Engine Diagnostic System (ATEDS) Contract DAAJ02-97-C-0014, CDRL Items A003, *Technical Report (Draft)*, and A004, *Technical Report (Final)*.

### 6.0 Discussion

#### 6.1 Development of Troubleshooting/Diagnostic Procedures

The following three separate sets of troubleshooting/diagnostic procedures were developed:

- T703-AD-700 engine (with supervisory electronic control system) and engine-to-aircraft interfaces
- 250-C30R/3 engine (except for control system) and engine-to-aircraft interfaces
- 250-C30R/3 Full Authority Digital Control System (FADEC) and FADEC-to-aircraft interfaces

For each of these categories, a set of observable or detectable symptoms was established and possible causes defined. A fault isolation/correction procedure was then developed for each symptom, considering all of the defined possible causes. The symptoms and the possible causes are presented in the following tables:

	<u>Category</u>	<u>No. of procedures</u>	<u>Table No.</u>
6.1.1	T703-AD-700 engine	51	I
6.1.2	250-C30R/3 basic engine	51	II
6.1.3	250-C30R/3 FADEC	57	III

*Table 1. List of faults for which isolation and correction procedures were developed:  
T703-AD-700 engine.*

Item*	Symptom	Possible causes or sources
ST-1	Starter unable to motor engine to fuel introduction speed	Low battery. Degraded starter. GG rotor rub or drag. Inlet or exhaust blockage
ST-2	Engine fails to light off	Air in fuel control or fuel lines. Aircraft battery. Faulty circuit to ignition unit. Faulty ignition exciter. Faulty spark igniter. Insufficient fuel in tank. Fuel control in cut off. Insufficient fuel pressure to fuel pump. Fuel nozzle valve stuck or orifice clogged. Fuel pump inoperative. Water or other contaminant in fuel. Improper fuel nozzle shimming. Combustor, outer combustion case. GGT 1st stage nozzle shield.
ST-3	Engine lights off prior to reaching fuel introduction speed. (Premature light off).	Fuel control cut off valve not closed. Combustor drain valve stuck closed
ST-4	Engine lights off normally but acceleration rate is slow with low TGT. May stagnate (hang) at around 30% Ng	Restricted fuel supply. Anti-icing or accessory bleed air on or leaking. Pneumatic leak in fuel control air sensing tubes or accumulators. Fuel control schedule shifted low. Electronic supervisory control. Excessive compressor air leakage. Low inlet fuel pressure at fuel pump. Fuel nozzle. Compressor erosion or damage.
ST-5	Engine lights off normally but acceleration rate is slow with higher than normal TGT	TGT indicating system error. Low battery. Degraded starter. Aircraft electrical system. Anti-icing air valve open and/or cabin heat on. Compressor bleed valve stuck closed. Fuel nozzle. Degraded compressor. Degraded turbine. Excessive gearbox load.
ST-6	TGT too high during start.	TGT indicating system error. Residual fuel in combustor. High residual TGT. Low battery. Degraded starter. Fuel nozzle. Excessive compressor bleed or leakage. Fuel control schedule shift. Electronic supervisory control.
ST-7	Engine accelerates to overspeed during start.	Fuel control throttle rigging. Frosting or icing in the fuel control Py governing orifice. Fuel control failure
ST-8	Engine lights off but flames out during ground starts at high altitude, especially above 5,000 ft (1542 meters) at cool temperatures,	Incorrect fuel type. Fuel nozzle coking. Combustor. Outer combustion case. GGT first stage nozzle shield.
ST-9	Compressor surge during starting	Foreign object damage or compressor erosion. Rich fuel control schedule. Bleed valve closing too early or stuck. Electronic supervisory unit.
ST-10	Main rotor (and Np) do not rotate by 25% Ng speed during start	Improper oil type in cold weather. Excess drag in aircraft drive train. Accessory gearbox internal fault.
ST-11	Rich, delayed light-off	Fuel control cutoff valve not fully closed, or leaking. Faulty ignition exciter, lead, or spark igniter. Faulty combustor drain valve. Faulty check valve in engine oil system. Fuel nozzle spray pattern or flow divider, fuel nozzle shimming

Table I (cont)

Item	Symptom	Possible causes or sources
ST-12	No oil pressure indication during start	Oil pump not properly primed. Restriction in oil pump supply line. Low oil level in tank. Dirty oil filter. Faulty aircraft oil pressure sensor or indicator- Leaks within the oil filter housing. Oil pressure regulator sticking. oil pump or oil pump drive failure. Accessory gearbox problem.
RG-1	Engine speed cycles (unstable) at ground idle (61-65% Ng).	Fuel control throttle rigging and/or security. Restriction in fuel supply. Aircraft electrical harness. Fuel control air sensing tube leak or fuel control malfunction. Electronic supervisory control. Compressor bleed control valve
RG-2	RG-2 Engine speed cycles (unstable) at 100% Nr/Np, main rotor at flat pitch.	Np beeper switch. Collective pitch position potentiometer. Fuel control throttle rigging or security, Restriction in fuel supply. Aircraft electrical harness. Fuel control air sensing tube leak. Fuel control malfunction. Compressor bleed valve control. Electronic supervisory control
RG-3	Idle speed does not repeat to the desired set point on repeated throttle movements from, and returning to, idle.	Fuel control throttle rigging or security. Fuel control malfunction. Electronic supervisory control.
RG-4	Idle speed too low. (shifted low from prior setting).	Incorrect fuel control throttle lever setting or idle speed adjustment incorrectly set. Ng tachometer error. Excessive generator load (will result in slightly higher than normal TGT)- Fuel control malfunction. Electronic supervisory control.
RG-5	Idle speed too high. Will not respond to idle speed decrease adjustment. May respond to gross idle speed increase adjustment.	Fuel control throttle lever setting or idle speed adjustment incorrectly set. Ng tachometer error. Fuel control malfunction. Electronic supervisory control.
RG-6	Fuel and/or oil leaking from fuel pump/fuel control overboard drain port.	Fuel pump drive shaft seal leaking. Gearbox seal leaking.
RG-7	Oil emanating from diffuser vent orifice.	Orifice improperly sized.
RG-8	Unable to stop engine with fuel control throttle movement to cut off.	Fuel control cut off valve not properly closing. Fuel control throttle rigging or security.
RG-9	Oil leaking from accessory gearbox drive(s).	There are ten output drive pads on the accessory gearbox, front and rear. Leakage from any of these, except the AGB breather gearshaft seal, can be repaired by replacement of the seal without engine removal.
RGF-1	Engine unstable in power range.	Fuel control throttle rigging or security. Collective pitch position potentiometer. Np beeper switch. Fuel supply restriction, Aircraft electrical harness. Fuel control pneumatic sensing tube leak. Bleed valve cycling. Fuel control malfunction. Electronic supervisory control.

Table I (cont)

Item	Symptom	Possible causes or sources
RGF-2	Compressor surges during acceleration from idle to governing at 100% Np/Nr.	Compressor damage or degradation. Compressor inlet blockage. Pressure or thermal distortion. Bleed valve closing too soon or stuck closed GG turbine 1st stage nozzle area reduced by blockage from ingested sand and dust deposits. Fuel control malfunction. Electronic supervisory control.
RGF-3	Excessive vibration	Engine mount looseness. Engine alignment. Main rotor or tail rotor drive systems. Damage or failure of compressor rotor, GGT, or PT rotor. Main or AGB bearings. GG or PT rotor unbalance. Accessory unbalance. Gear failure. Gear tooth match.
RGF-4	Exhaust duct emitting sparks.	Combustion liner damaged. Turbine or compressor damaged. Fuel nozzle.
RGF-5	Engine Ng or Np overspeeds.	Fuel control throttle linkage rigging or security. Speed measurement systems. Extreme flight maneuver. Output load loss. Engine wiring harness. Fuel control malfunction. Electronic supervisory control.
RGF-6	Excessive exhaust torching during transients.	Fuel nozzle. Fuel control. Electronic supervisory control.
RGF-7	Lack of anti ice air.	Cracked anti ice air tubes. Defective switch. Plug installed in solenoid valve. Anti-icing air valve stuck closed. Solenoid valve not working. Dirt collected in vane exit slots. Valve to scroll gasket.
RGF-8	Magnetic plug warning light.	Engine metal generation.
RGF-9	Faulty torquemeter indication.	Torquemeter bleed clogged. Torquemeter pressure sensing oil line clogged. Torque measurement system. Torque transducer or related wiring faulty. Torquemeter supporting bearing failure. Low main oil pressure
RGF-10	Continuous exhaust smoking.	Restricted power turbine sump scavenge strut or scavenge piping. Degraded oil pump. No. 5 seal leak. No.1 seal leak. Failed No. 5 bearing. Defective turbine seal. AGB breather gear lip seal. Oil transfer tubes. Aircraft scavenging system.
RGF-11	Oil spewing or leaking from gearbox vent and/or tubing joints.	AGB breather gearshaft lip seal leakage. High gearbox pressure caused by diffuser vent orifice too small or damaged. Worn or damaged turbine seals in the cooling air or pressure balance circuits.
RGF-12	Low oil pressure.	Oil level. Oil pressure measurement system. Oil pressure regulator. Engine oil filter. Degraded oil pump. Contaminated oil. Oil transfer tubes. Other internal oil leak. External leak. Oil supply restriction. High oil temperature.
RGF-13	High oil pressure.	Oil pressure measurement system. Oil passage obstruction in AGB. Turbine oil supply restriction.



Table I (cont)

Item	Symptom	Possible causes or sources
RGF-14	Oil pressure drops off severely with normal oil temperature.	Oil level. Pressure measurement system. Oil pressure regulator. Degraded oil pump. Oil transfer tubes. Aircraft oil system flow restriction. Oil foaming.
RGF-15	Oil temperature exceeds 107° C (225 °F)	Oil temperature measurement system. Aircraft oil cooler. Cooler bypass, or thermostat. Cooling fan damaged or obstructed.
RGF-16	Excessive oil pressure fluctuation.	Oil level. Pressure measurement system. Oil pressure regulator. Air in pressure sense line. Oil foaming. Aircraft oil system flow restriction. Oil pump.
RGF-17	Engine oil tank fills during flight as transmission oil level decreases.	Oil transferring through leaking seals at the front and/or rear AGB power output drives.
RGF-18	Transmission oil level increases during flight as engine oil tank empties.	Oil leaking, or being forced, through seals at front and/or rear AGB power output drives.
RF-1	Low power with high TGT.	Ng, Torque, or Np measuring systems. Dirty or degraded/damaged compressor. Degraded turbine. Blocked or distorted inlet. Blocked exhaust. Anti icing system on or leaking. External air leaks. Accessory bleed open. Degraded combustor. No 6 and 7 area labyrinth seals having excessive clearance.
RF-2	Low power with TGT below maximum limits.	Fuel control throttle lever not at its maximum stop Collective pitch to rotor rigging. Restriction in fuel supply.  Low inlet pressure to the fuel pump. Dirty fuel filter. Pneumatic leak in fuel control air sensing tubes. Clogged Pc filter or air sensing tube. Improperly shimmed or blocked fuel nozzle. Fuel control malfunction. Electronic supervisory control.
RF-3	Low measured TGT at normal or high power.	TGT Indicator, thermocouple, or harness. Engine electrical harness. Aircraft electrical harness. NOTE: IF THE ENGINE IS PRODUCING NORMAL POWER, THE FUEL CONTROL SYSTEM CANNOT CAUSE A TGT ERROR.
RF-4	Slow to accelerate to power. Rotor droop with collective pitch increase.	Pneumatic leak in fuel control air sensing tubes. Excessive generator load. Bleed valve stuck open. Excessive compressor air leakage. Fuel control. Electronic supervisory control.
RF-5	Oil consumption exceeds one quart per five hours of engine operation.	External leak, engine or aircraft. AGB lip seal leak. No. 1 seal leak. Turbine sump scavenge strut blockage or inadequate scavenging. High AGB case labyrinth seal leak. Dirty scavenge filter.
OFF-1	Bearing noise at compressor which may be accompanied by looseness of the impeller.	This is an indication of a bearing failure.
OFF-2	Engine will not crank. (Started unable to rotate engine).	Electrically failed or defective starter. Binding of compressor, turbine or gearbox.

*Table I (cont)*

Item	Symptom	Possible causes or sources
OFF-3	Starter will not rotate engine immediately after shutdown.	Binding of rotating components due to differential rate of cooling, or insufficient clearance.
OFF-4	Static oil leakage from power and accessory gearbox breather.	This is an indication that the oil filter check valve is leaking.
OFF-5	Fuel leaking from fuel control seep holes. Leakage may be blue in color and/or blue stain may be found on the lower external surface of the fuel control.	Fuel pump seal leak or fuel pump O-ring leaking.
OFF-6	Afterfire. TGT increase after shutdown indicating residual fire in the combustor	Fuel control cut off valve not fully closed. Oil leak. Sticking combustor drain valve. Combustor drain valve line obstruction.
OFF-7	Exhaust smoking during or immediately following engine shutdown. (Light wisps of smoke can be normal and are not cause for maintenance action unless oil consumption limits are exceeded).	Exhaust collector drain restricted. Combustor drain restricted. Blocked power turbine scavenge strut. Aircraft system scavenge flow restricted. Scavenge flow from turbine restricted. Defective turbine seals. Leaking oil transfer tubes or check valve. Defective oil pump.

\* Item number code letters indicate engine operating regime to which corresponding symptom applies, as follows:

<b>CODE</b>	<b>operating regime</b>
ST-	engine starting
RG-	engine running, on ground
RGF-	engine running, on ground or in flight
RF-	engine running, in flight
OFF-	engine shut down, not running

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*Table II. List of faults for which isolation and correction procedures were developed: 250-C30R/3 basic engine.*

Item No.	Operating regime	Fault description	Possible causes or sources
St-2	Start	Compressor surges during starts	ECU/HMU/inducer bleed duct restriction/inlet blockage/thermal distortion/compressor. damage or erosion/turbine blockage
St-3	Start	Flames out after light-off during start attempts at high altitude/cold ambient conditions	Fuel type/fuel nozzle coking/fuel nozzle immersion depth/combustion system
St-4	Start	Rich/delayed light-off	Intermittent (or faulty) ignition/fuel nozzle spray pattern/fuel nozzle flow divider/ECU/HMU/burner drain valve/external or internal lube check valve
St-5	Start	Motors to required speed but does not light off	Fuel supply/water in fuel/ignition/HMU rigging/fuel nozzle shimming/fuel nozzle coking/fuel nozzle flow divider valve stuck/combustor/outer combustion case/GGT 1st stage nozzle shield /HMU/ECU
St-6	Start	Lights off prior to scheduled fuel introduction speed	ECU/HMU/burner drain valve/HMU fuel valve leakage
St-7	Start	Lights off but will not accelerate to idle at normal rate	Fuel supply/compressor damage or erosion/low battery power/degraded starter/fuel nozzle tip carbon or flow divider/anti-icing or accessory bleed air on or air leaks/ECU/HMU
St-8	Start	MGT too high during start	Residual fuel in combustor/high residual MGT/low battery power/degraded starter/fuel nozzle flow divider valve stuck/excessive compressor air bleed or leakage/ECU/HMU
St-9	Start	MGT too low during start	ECU/HMU/MGT harness/MGT indicator calibration/engine electrical harness/engine accessory harness
St-10	Start	No oil pressure indicated during start	Low oil supply/oil pump not primed/oil filter element dirty/internal oil transfer tubes worn or leaking/oil supply restriction/oil pressure sensor or indicator calibration/oil pressure regulating valve stuck/failed oil pump or AGB
St-11	Start	No rotation of Nr/Np by 25% Ng during start	Helicopter rotor system drag/power turbine rotor system drag or lock-up/accessory gearbox power train drag or lock-up/wrong oil in cold environments
St-12	Start	Does not motor to required light-off speed	Low battery/degraded starter/internal oil transfer tubes or check valve leaking, causing AGB fill-up/gas generator rotor rub or drag/aircraft starter electrical circuits
St-13	Start	Starter will not rotate engine	Starter mechanically failed or defective/no voltage to starter/compressor rotor drag/gas generator turbine rotor drag/gas generator rotor frozen by ice/accessory gearbox failure

Table II. (cont)

Item No.	Operating regime	Fault description	Possible causes or sources
R-1	Run	Anti-icing system not operating properly	Electrical power/pilot valve/pilot valve vent/anti-icing air valve/valve-to-scroll gasket/anti-icing air supply tube/air tube from pilot valve to anti-icing valve/dirt in inlet guide vane exit slots
R-2	Run	Compressor surge/stall	ECU/HMU/compressor damage/compressor inlet blockage, pressure or thermal distortion/inducer bleed duct loose or restricted
R-3	Run	Exhaust duct emitting sparks	Fuel nozzle spray pattern/combustor burning or carbon/turbine/compressor rub, bearing failure, ingestion damage
R-4	Run	Exhaust torching during transients	ECU/HMU/fuel nozzle/external air leaks/cabin heater air leaks/anti-icing system air leaks
R-5	Run	Fuel leaking from HMU overboard drain port	HMU seal leak
R-6	Run	Ground idle speed too high or too low	ECU/HMU/power lever rigging/cockpit speed indication
R-7	Run	Magnetic chip detector warning	Chips/slivers/fuzz/accessory harness/aircraft wiring
R-8	Run	Low measured MGT at normal or high power	MGT harness/accessory harness/engine electrical harness/aircraft wiring/MGT indicator
R-9	Run	Ng or Np overspeed	Speed measurement systems/extreme maneuver/output load loss
R-10	Run	Ng or Np speed not indicating	Speed pick-up/speed indicator/engine electrical harness/engine-ECU interface harness/ECU to speed indicator aircraft wiring
R-11	Run	Oil consumption high (exceeding 1 quart per 5 hours engine operation)	External leak - engine or aircraft/AGB lip seal leaks/No. 1 seal leak/turbine sump scavenge strut blockage or inadequate scavenging/high AGB case pressure /No. 5 laby seal leak
R-12	Run	Oil leaking from accessory gearbox drive(s)	Drive pad lip seal/wet spline driveshaft seal
R-13	Run	Oil pressure drops off severely with normal oil temperature	Oil level/pressure measurement system/oil pressure regulator/degraded oil pump/oil transfer tubes/helicopter oil system flow restrictions/oil foaming
R-14	Run	Oil pressure fluctuates	Oil level/pressure measurement system/oil pressure regulator/air in pressure sense line/oil foaming/helicopter oil system flow restrictions/oil pump
R-15	Run	Oil pressure too high	Oil pressure measurement system/oil passage obstruction in AGB/turbine oil supply restriction
R-16	Run	Oil pressure too low	Oil level/oil pressure measurement system/oil pressure regulator/engine oil filter/oil transfer tubes/external leak/oil supply restriction/high oil temperature

Table II. (cont)

Item No.	Operating regime	Fault description	Possible causes or sources
R-17	Run	Engine oil tank fills during flight as aircraft transmission oil level decreases	PTO lip seal/aircraft overrunning clutch scavenge pump
R-18	Run	Aircraft transmission oil level increases during flight as engine oil tank empties	PTO lip seal/AGB case pressure (compressor seal vent pressure, turbine inner balance piston seal)/damaged lip seal land on PTO gearshaft
R-19	Run	Oil spewing or seeping from diffuser vent orifice and tubing joints	Compressor seal vent pressure set too low/bent or distorted tube flanges
R-20	Run	Oil spewing or seeping from gearbox vent and tubing joints	AGB air-oil separator gear lip seal/high AGB case pressure from compressor seal vent pressure set too high, or turbine inner balance piston seal wear or damage/bent or distorted tube flange
R-21	Run	Oil temperature exceeds 107° C (225°F)	Oil temperature measurement system/helicopter oil cooler, cooler bypass, or thermostat/cooling fan damaged or obstructed
R-22	Run	Power low with high MGT	Torque or MGT measurement systems/dirty compressor/damaged or degraded compressor or turbine/blocked or distorted compressor inlet/compressor inducer bleed blocked /anti-icing system on/external air leaks/accessory bleed open/degraded combustor
R-23	Run	Power low with MGT below maximum limit	Power lever rigging/collective pitch-to-rotor rigging/fuel restriction, low fuel inlet pressure, dirty fuel filter/ECU/HMU
R-24	Run	Slow acceleration/NP droop	Collective pitch potentiometer rigging or fault
R-25	Run	Smoking during steady state operation	Restricted power turbine sump scavenge strut or scavenge piping/degraded oil pump/No. 5 laby seal/AGB breather gear lip seal/oil transfer tubes/No. 1 bearing or oil seal/aircraft scavenging system/worn turbine seals
R-26	Run	Smoking during transients	Restricted power turbine sump scavenge strut or scavenge piping/degraded oil pump/No. 5 laby seal/AGB breather gear lip seal/oil transfer tubes/worn turbine seals
R-27	Run	Faulty torquemeter indication	Cockpit torque measurement system/engine torquemeter/engine torquemeter transducer or related wiring/obstruction in oil tube from engine to transducers/low main oil pressure/ECU
R-28	Run	Unstable in power turbine governing (95%--105% Np)	ECU/HMU/power lever rigging and security/collective pitch position potentiometer/Np beeper switch/fuel supply restriction/engine, accessory, interface, or aircraft electrical harness

Table II. (cont)

Item No.	Operating regime	Fault description	Possible causes or sources
R-29	Run	Unstable at ground idle	ECU/HMU/power lever rigging and security/fuel supply restriction/engine, accessory, interface, or aircraft electrical harness/Ng speed measuring system
R-30	Run	Vibration excessive	Mount looseness/engine alignment/helicopter drive system/damage or failure of compressor rotor, GGT or PT rotor/main or AGB bearing(s)/GG or PT rotor unbalance/accessory unbalance/gear failure/gear tooth mesh
Sd-1	Shutdown	Afterfire (rising MGT after shutdown)	HMU/power lever rigging/burner drain valve/turbine internal oil leak
Sd-2	Shutdown	Compressor bearing noise or loose compressor rotor	Front compressor bearing/rear compressor bearing
Sd-3	Shutdown	Smoking during shutdown	Exhaust collector drain/leaking No. 5 laby seal/AGB air-oil separator gear lip seal/oil transfer tubes/oil check valve to turbines/burner drain valve/restricted scavenge to turbine sumps/defective turbine seals/oil pump/restricted aircraft oil system
Sd-4	Shutdown	Unable to stop engine with twist grip	HMU/power lever rigging/aircraft throttle linkage
Off-1	Off	Filter (engine fuel) impending bypass indicator extended	Dirty filter element/ contaminated fuel system/faulty pop-out
Off-2	Off	Filter (main oil) impending bypass indicator extended	Dirty filter element/contaminated oil/faulty pop-out
Off-3	Off	Oil reservoir level lowering with engine inoperative	Internal oil check valve/oil transfer tube leaks at oil filter housing/other internal AGB oil leaks or scavenge pump problems/aircraft system restrictions
Off-4	Off	Oil runs from burner drain valve after shutdown	Internal oil check valve/external oil check valve
Off-5	Off	Starter will not rotate engine immediately after shutdown	Turbine blade tip rub/compressor rub/AGB GG gear train failure

*Table III. List of faults for which isolation and correction procedures were developed:  
Model 250-C30R/3 FADEC.*

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
1	STEPPER MOTOR CIRCUIT FAULT	SmFlt SmPhAVFlt SmPhBVFlt SmPhCVFlt SmPhDVFlt SmPhIFlt	Stepper motor fault Stepper motor phase A voltage fault Stepper motor phase B voltage fault Stepper motor phase C voltage fault Stepper motor phase D voltage fault Stepper motor phase current fault
2	HOT START ABORT SOLENOID CIRCUIT FAULT	StSFlt StSIFlt	Start solenoid V bit fault Start solenoid current fault
3	AUTO/MANUAL CHANGEOVER SOLENOID CIRCUIT FAULT	AMIFlt AMSolFlt	Auto/Manual solenoid BIT current fault Auto/Manual mode solenoid fault
4	OVERSPEED SYSTEM POWER-UP SELF TEST FAULT	OSI12Flt  OSTst1Flt OSTst2Flt OSTst3Flt OSTst4Flt OSTst5Flt OSTst6Flt OSTst7Flt	Overspeed BIT current fault  Overspeed test 1 failed Overspeed test 2 failed Overspeed test 3 failed Overspeed test 4 failed Overspeed test 5 failed Overspeed test 6 failed Overspeed test 7 failed
5	METERING VALVE POSITION POTENTIOMETER CIRCUIT FAULT	WfmvFlt  WfmvRgFlt WfmvRtFlt	Fuel metering valve fault  Fuel metering valve range fault Fuel metering valve rate fault
6	POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT	PLA12Flt  PLA1Flt PLA1RgFlt PLA2Flt PLA2RgFlt PLADFlt	PLA hard fault  PLA1 potentiometer input fault PLA1 range fault PLA2 potentiometer input fault PLA2 range fault (PLA1Raw-PLA2Raw) difference fault



Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
6 (cont.)	PLA POTENTIOMETER CIRCUIT FAULT (CONT.)	PLAHdFit PLARfFit PLARfRgFit	PLA hard fault PLA reference voltage fault PLA reference voltage range fault
7	CIT (T1) TEMPERATURE SENSOR CIRCUIT FAULT	T1ABFit T1AFit T1ARgFit T1ARtFit T1BFit T1BRgFit T1BRtFit T1DFit	T1 hard fault T1A fault T1A range fault T1A rate fault T1B fault T1B range fault T1B rate fault (T1ARaw-T1BRaw) difference fault
8	Np (N2) SPEED SENSOR CIRCUIT FAULT	Np12Fit Np1CyFit Np1Fit Np1RgFit Np1RtFit Np2CyFit Np2Fit Np2RgFit Np2RtFit NpDFit	Np hard fault Np1 continuity check fault Np1 speed pickup fault Np1 range fault Np1 rate fault Np2 continuity check fault Np2 speed pickup fault Np2 range fault Np2 rate fault (Np1Raw-Np2Raw) difference fault
9	Ng (N1) SPEED SENSOR CIRCUIT FAULT	Ng12Fit Ng1CyFit Ng1Fit Ng1RgFit Ng1RtFit Ng2CyFit Ng2Fit Ng2RgFit Ng2RtFit	Ng hard fault Ng1 continuity check fault Ng1 speed pickup fault Ng1 range fault Ng1 rate fault Ng2 continuity check fault Ng2 speed pickup fault Ng2 range fault Ng2 rate fault

Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
10	MGT (TGT) THERMOCOUPLE CIRCUIT FAULT	MGTFIt MGTRgFit MGTRtFit	MGT thermocouple fault MGT range fault MGT rate fault
11	PERMANENT MAGNET ALTERNATOR (PMA) CIRCUIT FAULT	AI28Fit	Alternator (PMA) fault
12	TORQUE (TMOP OR Q) MEASUREMENT FAULT	QFit QRgFit QRtFit QVIdFit	Torque sensor fault Q range fault Q rate fault In-range torque fault
13	COLLECTIVE PITCH (CP) POTENTIOMETER CIRCUIT FAULT	CPAntFit  CPFit CPRgFit	Collective pitch hard fault  Collective pitch fault Collective pitch range fault
14	Nr SPEED SENSOR CIRCUIT FAULT	NrAntDsb NrCyFit NrFit NrRgFit NrRtFit	Disable rotor decay anticipation Nr continuity check fault Nr fault Nr range fault Nr rate fault
15	ECU P1 TRANSDUCER FAULT	P1Fit P1HdFit P1RgFit P1RtFit	P1 pressure sensor fault P1 hard fault P1 range fault P1 rate fault
16	ECU INTERNAL FAULT	AD12BitFit AD8BitFit ARINCHWFit BacCompFit BVIFit  CJCFit CJCrgFit CJCrtFit	12 bit A/D conversion fault 8 bit A/D conversion fault ARINC hardware fault Background complete fault Bleed valve solenoid BIT current fault  Thermocouple cold junction comp fault Thermocouple cold junction comp range fault Thermocouple cold junction comp rate fault

Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
16 (cont.)	ECU INTERNAL FAULT (CONT.)	ECUOTFit	ECU exceeding allowable temperature
		EECalFit	EEPROM calibration data fault
		EEHistFit	EEPROM engine history data fault
		EEPROMFit	EEPROM hardware fault
		ForCompFit	Foreground complete fault
		GainFit	Gain fault
		GainRgFit	Gain range fault
		HLRfFit	High level reference voltage fault
		HLRfRgFit	High level reference voltage range fault
		IgnFit	Ignition circuit fault
		OffsFit	Low level offset fault
		OffsRgFit	Low level offset range fault
		OrDiodeFit	"OR" diode fault
		OSVFit	Overspeed system voltage fault
		OSVRgFit	OSV voltage range fault
		PROMFit	PROM hardware fault
		PW10Fit	10 volt pulse width modulator fault
		PW10RgFit	10 volt pulse width modulator range fault
		RAMFit	RAM hardware fault
		StrFit	Starter motor circuit fault
		SWIntFit	Software interrupt fault
		UARTFit	UART hardware fault
		UUIntFit	Unused interrupt fault
		V15Fit	15 volt power supply fault
		V15RgFit	15 volt power supply range fault
		V5Fit	5 volt power supply fault
		V5RgFit	5 volt power supply range fault
		WDTFit	Watchdog timer fault
		WDTOutFit	Watchdog timer first timeout fault
17	AIRFRAME 28VDC SUPPLY FAULT	AF28Fit	28 volt airframe power fault
		AF28RgFit	28 volt airframe power range fault

Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
18	OVERSPEED SYSTEM PUSH-TO-TEST SWITCH CIRCUIT FAULT	OSTstSwFlt	Overspeed test switch fault
19	FADEC MODE SWITCH CIRCUIT FAULT	AMSwFlt	Auto/Manual switch fault
20	IGNITION CIRCUIT FAULT	IgnlFlt	Ignition relay fault
21	STEP COUNT FAULT	StepCntFlt	Step count fault
21		WfStFlt	Fuel flow step count fault
21		WfStRgFlt	Fuel flow step count range fault
22	OPEN METERING VALVE INDICATION	OpenMVFlg	Open metering valve warning prior to start
23	OVERSPEED SYSTEM ENGINE SHUTDOWN TEST FAULT	OSTestFlt	Automatic overspeed test fault
24	OVERSPEED SYSTEM Np SPEED SIGNAL FAULT	NpOSFlt	Np overspeed fault
25	WATCHDOG TIMER HARD FAULT	WDTTimeOut	Watchdog timer hard fault
26	UNUSED DISCRETE INPUT FAULT	TestCelFlt	Engine operating in test cell mode
27	INCORRECT MAINTENANCE MESSAGE CODES	ARINCFitAn CPDFit FTempFlt LoadSelFlt LoadSHdFlt NgOFit NgORgFlt NgORtFlt NrDFit P1DFit	NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION NOT VALID FOR THIS INSTALLATION
28	SECONDARY FAULT CODES	AMFlt HardFlt Or28Flt Or28RgFlt OSFlt TempFlt WfHdFlt	Auto/Manual fault ECU hard fault (fail fixed) 28V OR'ed power fault 28V OR'ed power range fault Overspeed system functional fault MGT temperature fault Fuel flow hard fault

Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
29	ENGINE LIMITS EXCEEDED	MGTLMtOut MGTRLmTOut MGTSLmTOut MGTSRLmTOut NgLmTOut NgRLmTOut NpLmTOut NpQExLmAdv NpQRnLmAdv OSFlag QLmTOut QRLmTOut	MGT limit exceedence MGT run limit exceedence for 12 or more sec. MGT start limit exceedence MGT start run limit exceedence for 9 or more sec. Ng limit exceedence Ng run limit exceedence for 10 seconds Np limit exceedence NpQ exceedence limit advisory indicator NpQ run limit advisory indicator Engine overspeed flag Q limit exceedence Q run limit exceedence for 10 seconds
30	FUEL FLOW LIMIT EXCEEDED	WFLimFlag	Fuel flow has been limited > 10 seconds
31	ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT FAULT	BeepFlt	Cockpit Nr beep fault
32	ROTOR SPEED TRIM "BEEPER" SWITCH STUCK	BpStuckFlt	Beep stuck fault
33	INTERMITTENT FAULT PROCEDURE	Not Applicable	
34	FADEC FAIL WARNING (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
35	FADEC FAIL WARNING (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
36	FADEC MANUAL WARNING (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
37	FADEC MANUAL WARNING (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
38	Ng (N1) COCKPIT GAUGE INOPERATIVE OR ERRATIC	Observed condition	See Fault Category Name

Table III. (cont)

Item No.	FADEC fault category	Maintenance terminal fault code	Fault description
39	Np (N2) COCKPIT GAUGE INOPERATIVE OR ERRATIC	Observed condition	See Fault Category Name
40	OVERSPEED TEST FAILS TO OPERATE	Observed condition	See Fault Category Name
41	ENGINE OUT WARNING (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
42	ENGINE OUT WARNING (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
43	FADEC MAINT. ADVISORY (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
44	FADEC MAINT. ADVISORY (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
45	FADEC FAILS FIXED WITH NO MFD FADEC FAIL WARNING	Observed condition	See Fault Category Name
46	MANUAL MODE OPERATIONAL PROBLEM	Observed condition	See Fault Category Name
47	MAINTENANCE TERMINAL COMMUNICATION FAULT	Observed condition	See Fault Category Name
48	FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
49	FADEC DEGRADE - DROOP MESSAGE (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
50	FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
51	FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
52	FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
53	FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
54	FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
55	FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD) INCORRECTLY "OFF"	Observed condition	See Fault Category Name
56	FADEC DEGRADE - TGT (OR MGT) LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name
57	FADEC DEGRADE - TGT (OR MGT) LIM LOSS MESSAGE (MFD) INCORRECTLY "ON"	Observed condition	See Fault Category Name

The fault isolation/correction procedures were structured to follow a logic that, after listing the symptom and possible causes, specified an initial inspection, measurement, or test, the results of which could be answered *yes* or *no*. The subsequent step branched from the *yes-no* decision to another inspection, measurement, or test, to the next *yes-no* decision point, and onward until the fault was isolated and corrected. At each step where an inspection, measurement, or test was specified, the corresponding detailed task or procedure from the applicable Technical Manual was referenced. Where no relevant manual (or manual update) was available, such as the airframe manual associated with the 250-C30R/3 engine, similar sections of the T703-AD-700 powered airframe manual (TM55-1520-248-23) were referenced with the notation "*similar to. . .*"

## 6.2 Visio Flow Charts of Troubleshooting/Diagnostic Procedures

The troubleshooting/diagnostic procedures were arranged in flow chart format, using Visio software, and are presented as follows:

	<u>Category</u>	<u>Appendix</u>
6.2.1	T703-AD-700 engine	A
6.2.2	250-C30R/3 basic engine	B
6.2.3	250-C30R/3 FADEC	C

Although the creation of the Visio charts is an interim step in the execution of this ATEDS contract, note that even in the graphic format they provide a more systematic approach to fault isolation and correction than has heretofore been available to the mechanic, and thus may be useful in maintaining the OH-58D fleet until ATEDS is implemented.

## 6.3 Standard Generalized Markup Language (SGML) Tagged Data

The text and logic from Visio charts of the troubleshooting/diagnostic procedures were used directly as inputs to the SGML tagging. SGML tagged data, while the final product of this contract, is not the final step in creating the envisioned Aviation Turbine Engine Diagnostic System. The tagged data must be processed with other software to provide the meaningful portable computer input/output a mechanic would use to maintain the engine.

Appendix D contains a printout of a sample SGML-tagged data file, based on one of the simpler fault correction procedures (250-C30R/3 basic engine procedure R-6—*Gas Generator Idle Speed Too High or Too Low*)—to provide a general view of the structure of the language. A complete set of the tagged data files, for all 159 procedures, has already been provided to the Army on CD-ROM and is not included herein.

A brief description of the SGML tagging process, as well as identification of the additional software required to provide a useable system, is also included in Appendix D.

## 6.4 Specialized Test Equipment Required to Support Troubleshooting and Diagnosing

Specialized test equipment required to implement troubleshooting of engine and engine-to-aircraft interface faults is presented in Appendix E. Six items were identified. A list, relating specific equipment to the various troubleshooting procedures, is also included. A variety of equipment required to perform common maintenance and repair functions, such as special lifting and handling fixtures, wrenches, lip seal pullers, vibration measuring systems, etc., is already in the Army inventory and thus currently available.

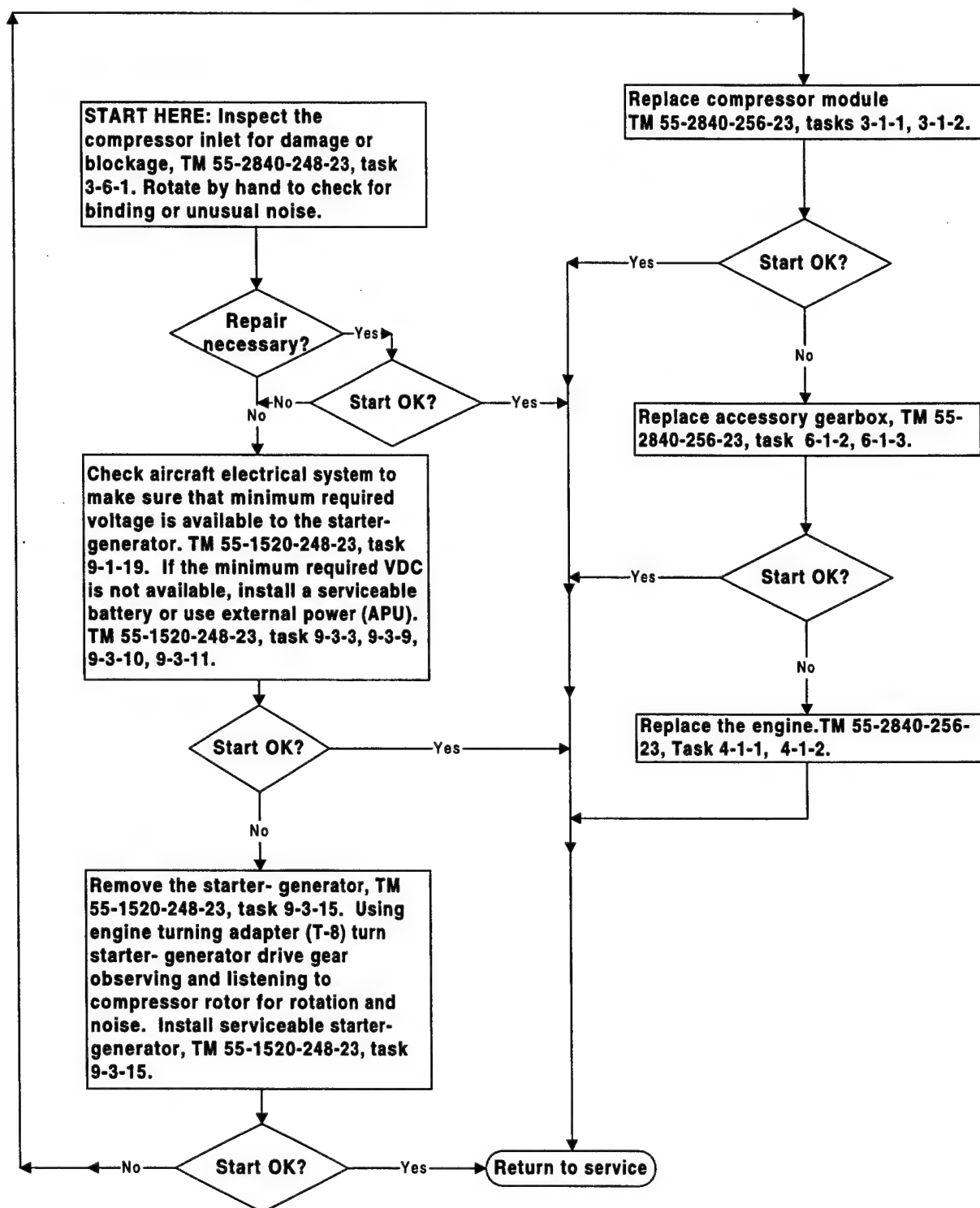
**Appendix A**  
**T703-AD-700 Fault Isolation and Correction Visio Charts**  
51 Procedures (63 pages)



# ST-1 STARTER UNABLE TO MOTOR ENGINE TO FUEL INTRODUCTION SPEED (12 - 15% Ng).

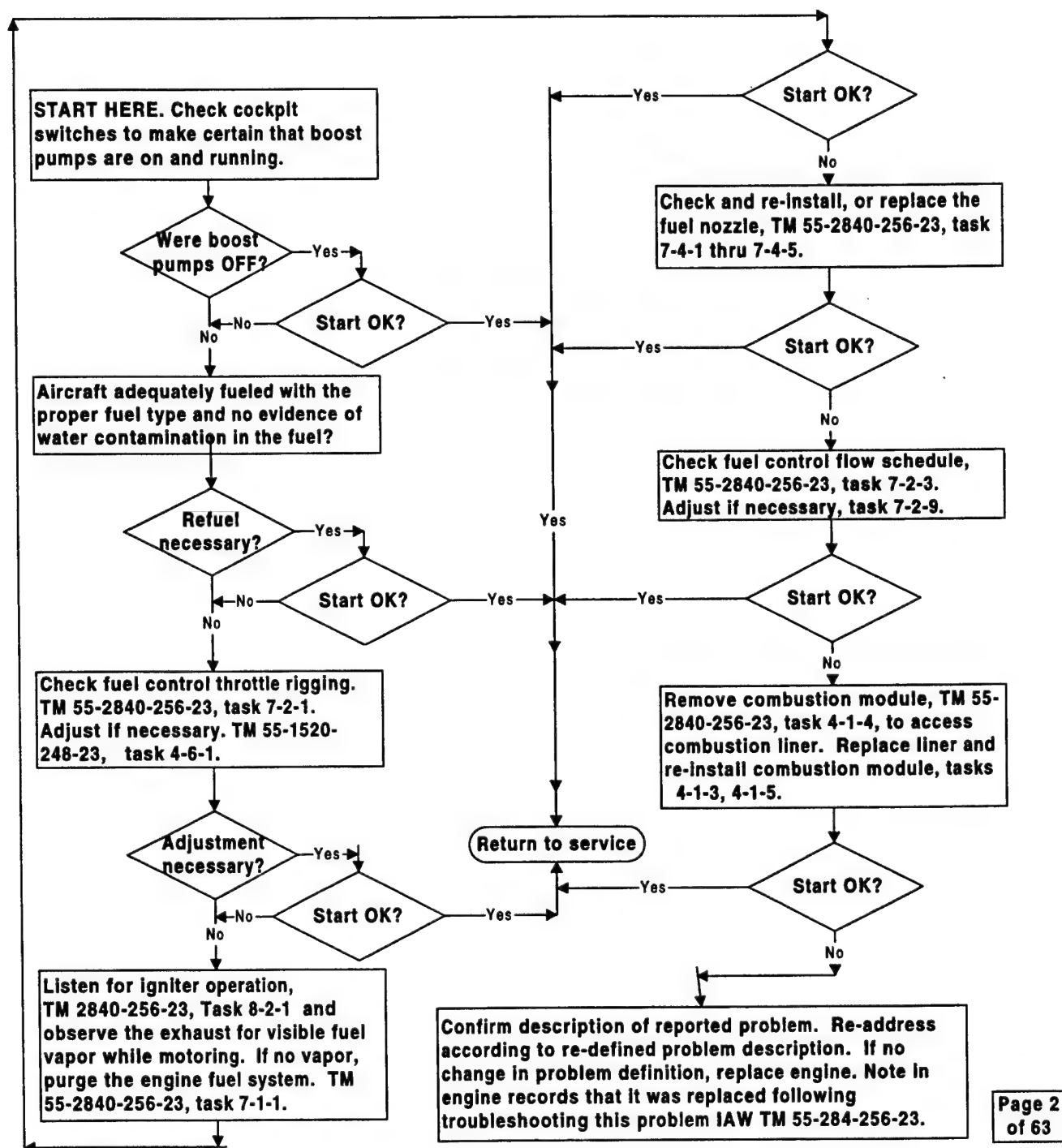
Page 1 of 1

**THIS MAY BE CAUSED BY:** Low battery Inefficient starter. GGT rotor or turbine rub or drag. Inlet blockage or exhaust blockage or damage.



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**THIS MAY BE THE RESULT OF:** Fuel control throttle in cut off. Air in the fuel control or lines. Empty fuel tank. Insufficient fuel to the fuel pump. Fuel pump inoperative. Vapor or other contaminant in the fuel. Improperly shimmed fuel nozzle. Fuel nozzle flow divider valve stuck closed. Fuel nozzle coking. Faulty circuit to the ignition unit. Faulty ignition exciter or spark igniter. Combustion liner. Outer combustion case. GGT 1st stage nozzle shield.



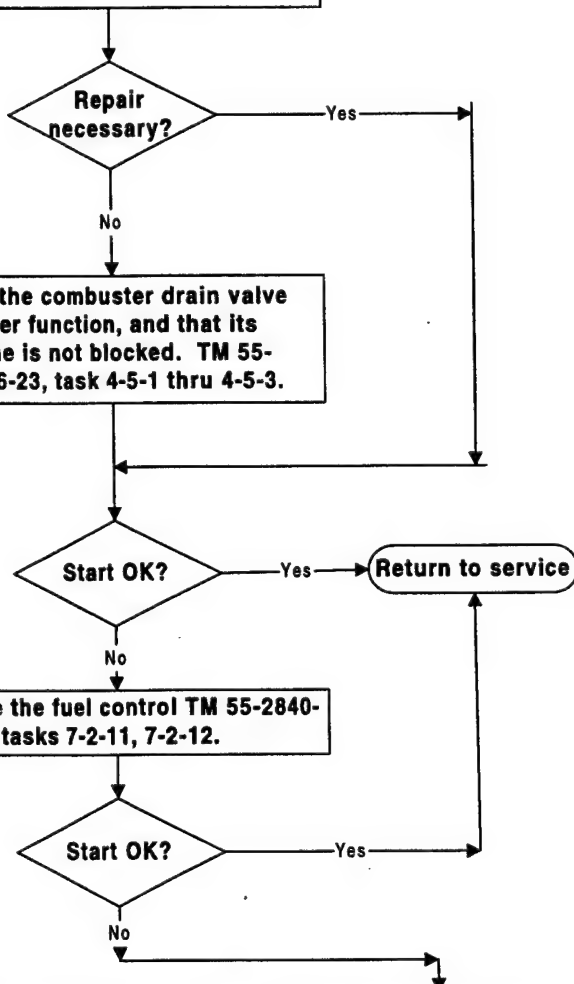
**ST-3 ENGINE LIGHTS OFF PRIOR TO REACHING FUEL INTRODUCTION SPEED. (PREMATURE LIGHT OFF).**

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**THIS MAY BE CAUSED BY:** Fuel control cut off valve leaking or not closed during initial crank. Combuster drain valve stuck closed.

**NOTE:** If light-off occurs at a very low cranking speed, a hot start will usually result unless fuel flow to the engine is immediately shut off by either throttle closure or by fuel shut valve closure if the fuel control cutoff valve is leaking.

**START HERE:** Inspect the fuel control throttle linkage and cut off valve to make certain that the throttle lever is against its minimum stop and cutoff valve is seated, TM 55-2840-256-23, tasks 7-2-1, 7-2-6.



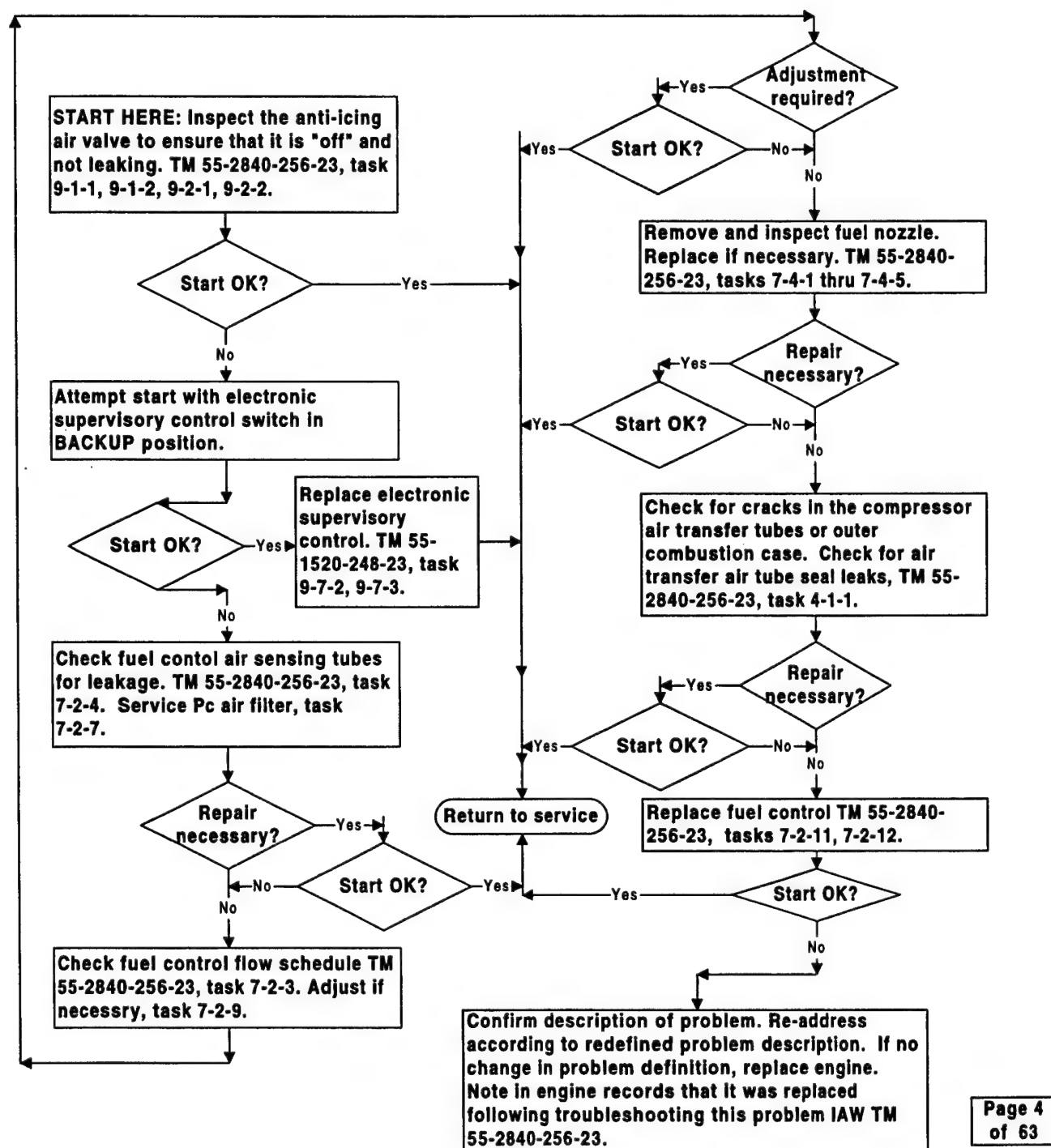
**Confirm description of problem. Re-address according to re-defined problem description. If no change in problem definition, replace engine. Note in engine records that it was replaced following troubleshooting this problem IAW TM 55-2840-256-23.**

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**ST-4 ENGINE LIGHTS OFF BUT ACCELERATION RATE IS SLOW WITH LOW TGT (APPROX. 550 Degrees C.) MAY STAGNATE (HANG) AROUND 30% Ng.**

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**THIS MAY BE CAUSED BY:** Restricted fuel supply. Low fuel pressure at pump inlet. Anti-icing air or accessory bleed air on. Pneumatic leak in the fuel control Pc supply system. Fuel nozzle carbon. Compressor damage or erosion. Excessive compressor air leakage. Fuel control malfunction. Electronic supervisory control.

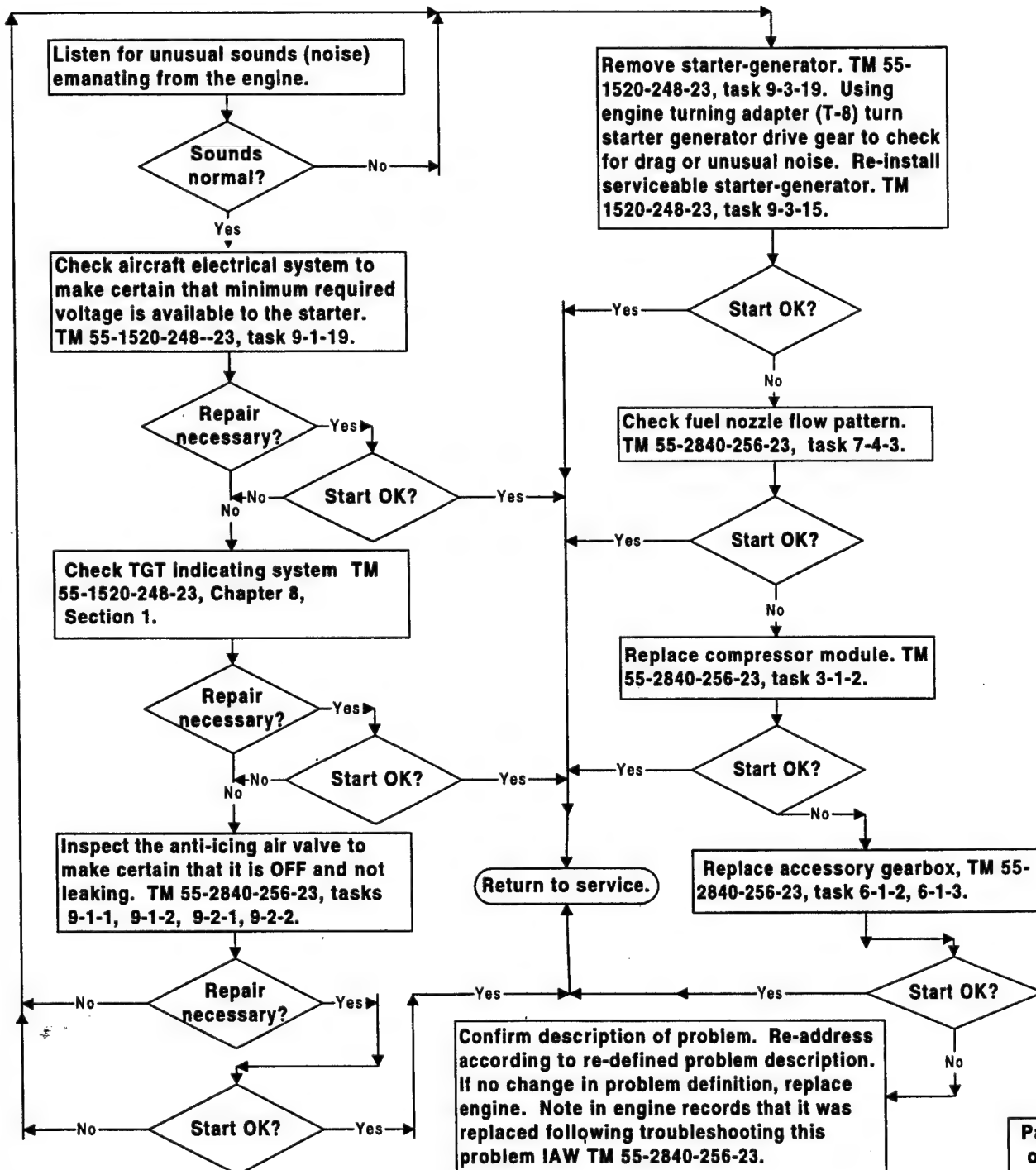


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**ST-5 ENGINE LIGHTS OFF BUT ACCELERATION RATE IS SLOW WITH HIGHER THAN NORMAL TGT.**

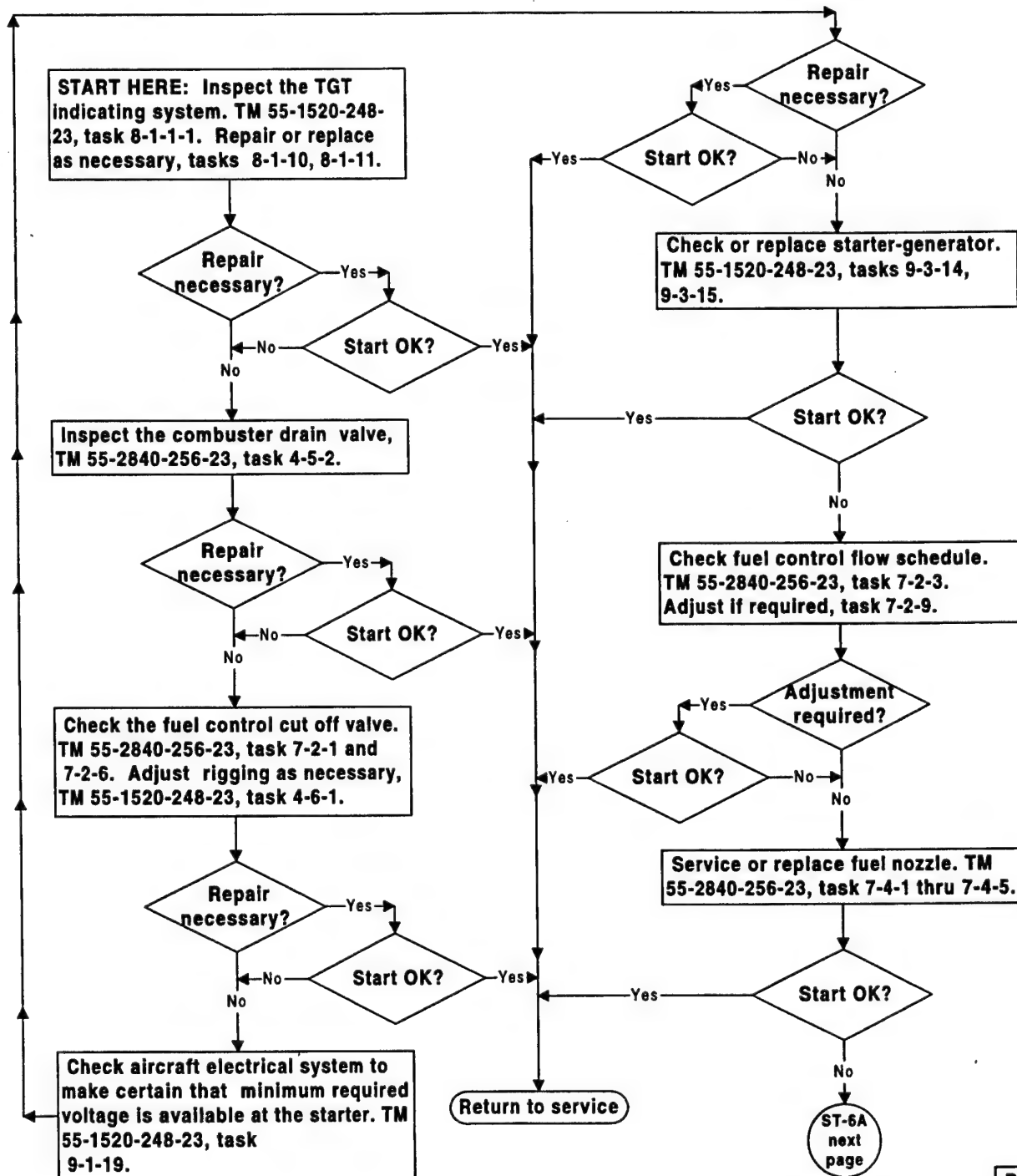
Page 1 of 1

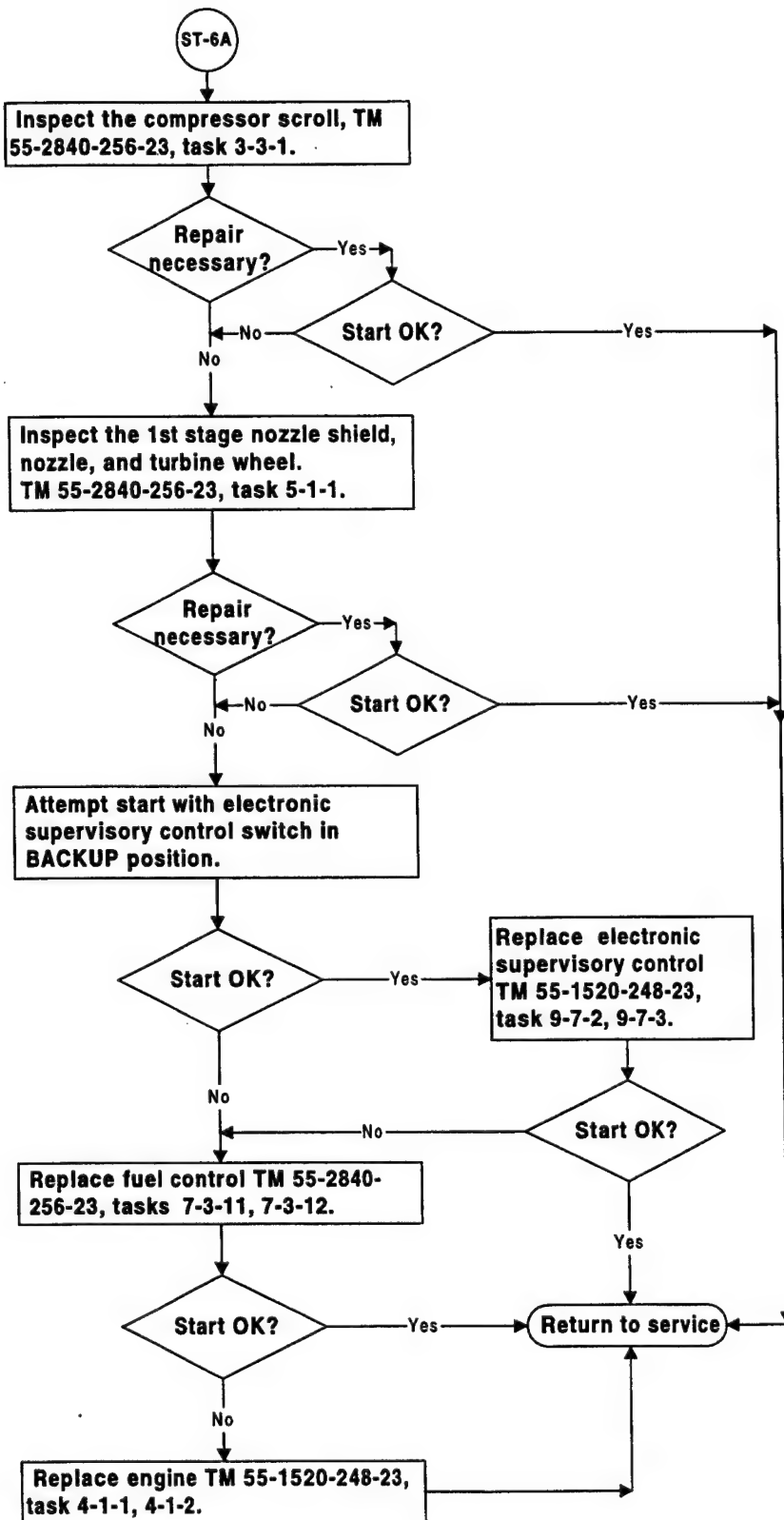
**THIS MAY BE CAUSED BY:** TGT indicating system error. Low battery. Degraded starter. Anti-icing air valve open or cabin heat on. Compressor bleed valve stuck closed (T703-AD-700 engine only). Fuel nozzle valve stuck open. Degraded compressor. Degraded turbine. Aircraft electrical system. Excessive gearbox load.



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**THIS MAY BE CAUSED BY:** TGT indicating system error. Residual fuel in the combustor. High residual TGT. Insufficient starter torque. Low battery. Fuel nozzle flow divider valve stuck. Excessive compressor bleed air leakage. Fuel control flow schedule shift. Electronic supervisory control.





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graph TD
    Start[START HERE: Check the fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Rig and adjust as necessary, TM 55-1520-248-23, task 4-6-1] --> Fault1{Fault corrected?}
    Fault1 -- Yes --> Return1([Return to service])
    Fault1 -- No --> Perform[Perform another start. If Ng continues to increase beyond idle (63-65%) use the twist grip start modulation range below idle to control Ng in the normal idle speed range (63-65%) until the fuel control warms up.]
    Perform --> Ng1{Ng controllable by modulation?}
    Ng1 -- Yes --> Join1(( ))
    Ng1 -- No --> Shutdown[Shut down and try another start, again attempting to control Ng speed by modulation. Repeat this shut down and re-start every 3-4 minutes for a total of not more than 4 attempts.]
    Shutdown --> Ng2{Ng controllable by modulation?}
    Ng2 -- Yes --> Join1
    Ng2 -- No --> Start
    
    Join1 --> Service[Service the fuel control Px and Py restrictor orifices, TM 55-2840-256-23, task 7-2-8. Start and run the engine to verify proper idle operation and governing at 100% Nr/Np with rotor at flat pitch.]
    Service --> Fault2{Fault corrected?}
    Fault2 -- Yes --> PerformDec[Perform a slow deceleration and acceleration between maximum twist grip setting and idle to confirm proper Np governing action.]
    Fault2 -- No --> Fault3{Fault corrected?}
    PerformDec --> Fault3
    Fault3 -- Yes --> Return2([Return to service])
    Fault3 -- No --> Replace[Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.]
    Replace --> Return2
    
```

**START HERE: Check the fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Rig and adjust as necessary, TM 55-1520-248-23, task 4-6-1**

**Fault corrected?**

Yes → **Return to service**

No → **Perform another start. If Ng continues to increase beyond idle (63-65%) use the twist grip start modulation range below idle to control Ng in the normal idle speed range (63-65%) until the fuel control warms up.**

**Ng controllable by modulation?**

Yes → **As the fuel control warms and it becomes possible to advance the twist grip throttle without Ng exceeding idle (63-65%), slowly advance twist grip toward the idle position. After sufficient warming to permit engine operation in the idle speed range with twist grip at the idle detent, slowly increase twist grip setting until Nr/Np reach 100% with rotor at flat pitch. Continue to advance twist grip to its maximum stop position. If Nr/Np continue to hold at 100%, the governor system is now controlling the engine normally. If Nr/Np tend to exceed 100%, use the twist grip throttle to limit Nr/Np for 3 or 4 minutes to allow further warming. If still unable to advance twist grip to its full open stop without overspeeding Nr/Np, return to idle and shut the engine down,**

No → **Shut down and try another start, again attempting to control Ng speed by modulation. Repeat this shut down and re-start every 3-4 minutes for a total of not more than 4 attempts.**

**Ng controllable by modulation?**

Yes → **As the fuel control warms and it becomes possible to advance the twist grip throttle without Ng exceeding idle (63-65%), slowly advance twist grip toward the idle position. After sufficient warming to permit engine operation in the idle speed range with twist grip at the idle detent, slowly increase twist grip setting until Nr/Np reach 100% with rotor at flat pitch. Continue to advance twist grip to its maximum stop position. If Nr/Np continue to hold at 100%, the governor system is now controlling the engine normally. If Nr/Np tend to exceed 100%, use the twist grip throttle to limit Nr/Np for 3 or 4 minutes to allow further warming. If still unable to advance twist grip to its full open stop without overspeeding Nr/Np, return to idle and shut the engine down,**

No → **START HERE: Check the fuel control throttle rigging. TM 55-2840-256-23, task 7-2-1. Rig and adjust as necessary, TM 55-1520-248-23, task 4-6-1**

**Service the fuel control Px and Py restrictor orifices, TM 55-2840-256-23, task 7-2-8. Start and run the engine to verify proper idle operation and governing at 100% Nr/Np with rotor at flat pitch.**

**Fault corrected?**

Yes → **Perform a slow deceleration and acceleration between maximum twist grip setting and idle to confirm proper Np governing action.**

No → **Fault corrected?**

Yes → **Return to service**

No → **Replace fuel control, TM 55-2840-256-23, task 7-2-11, 7-2-12.**

**Return to service**

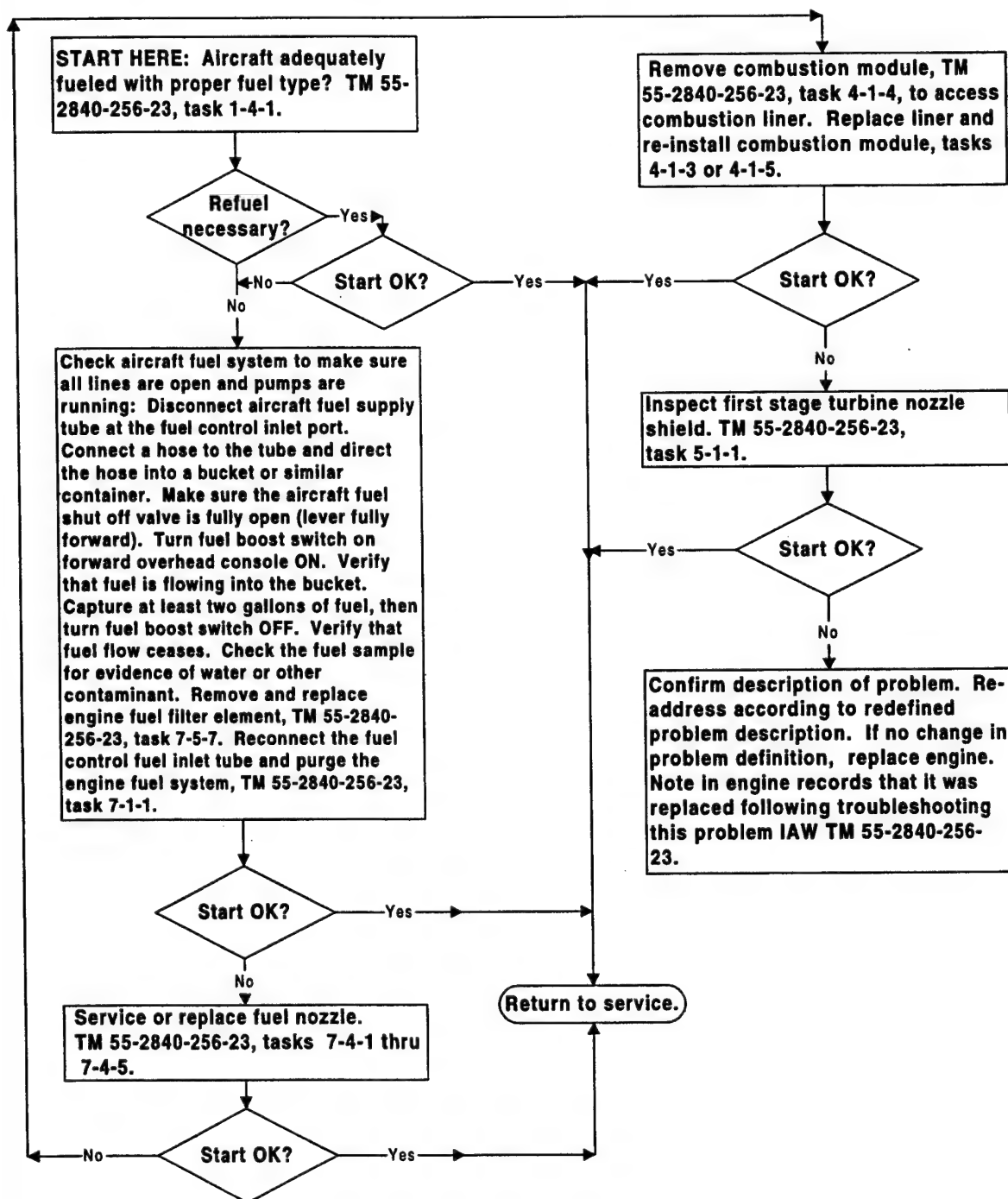
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**ST-8 ENGINE LIGHTS OFF BUT FLAMES OUT DURING GROUND STARTS AT HIGH ALTITUDE, ESPECIALLY ABOVE 5000 FT. (1824 METERS) AT COOL TEMPERATURES.**

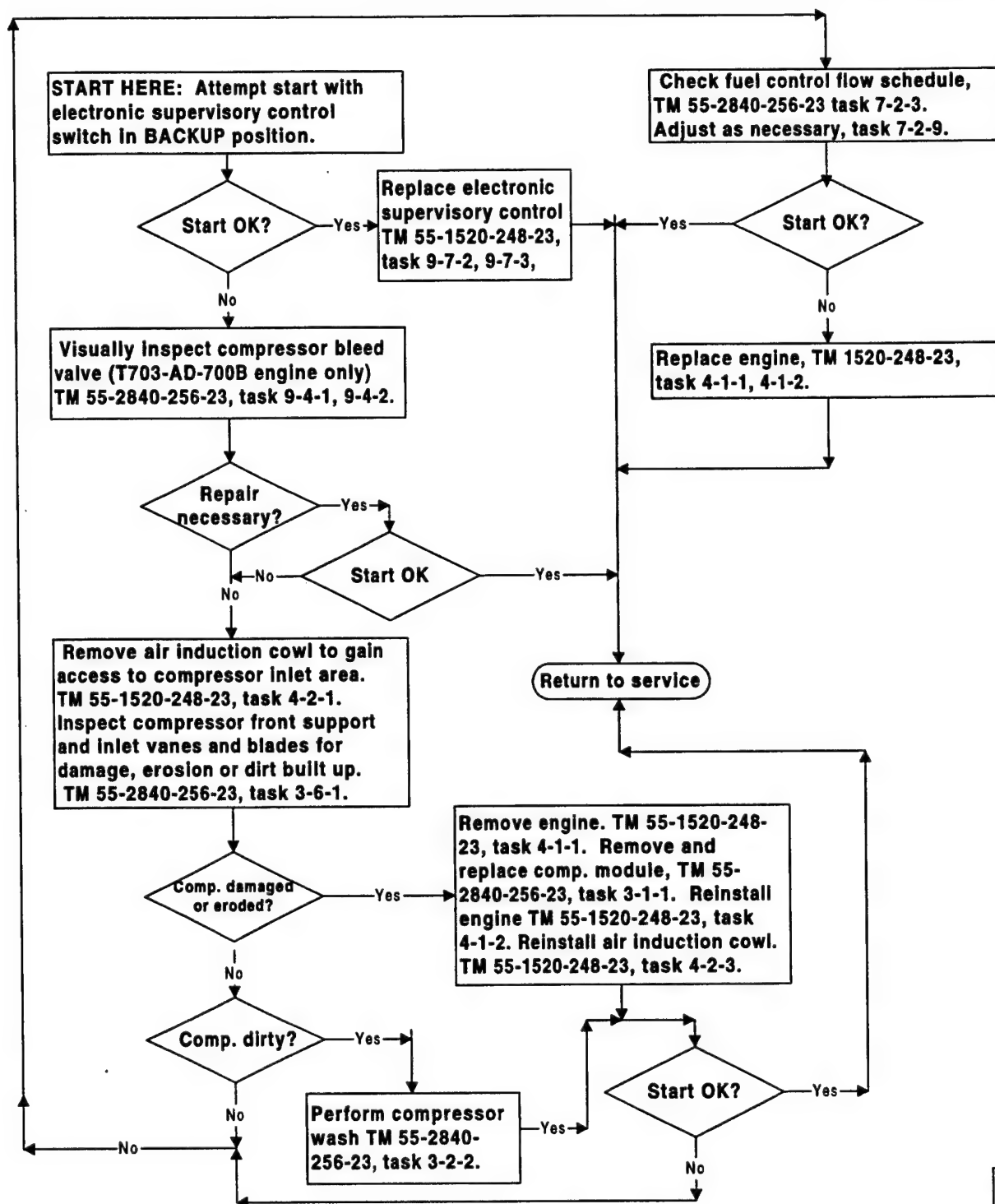
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**THIS MAY BE CAUSED BY:** Using incorrect fuel type. Fuel nozzle coking. Combustor. Outer combustion case. GGt 1st stage nozzle shield.



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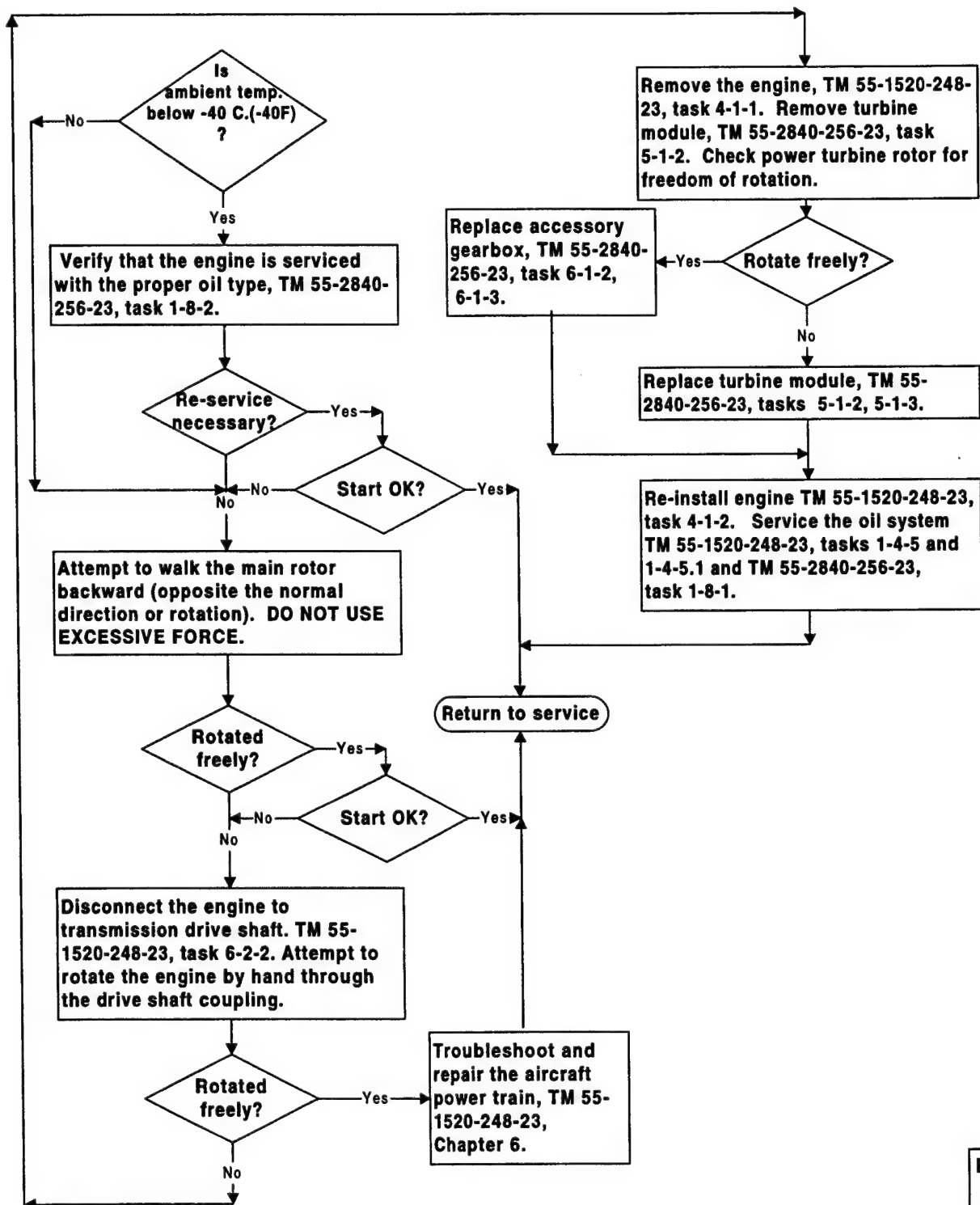
**THIS MAY BE CAUSED BY:** Foreign object damage. Compressor erosion. Fuel control schedule shifted high. Compressor bleed valve stuck closed (T703-AD-700B engine only). Electronic supervisory control.



# ST-10 MAIN ROTOR AND Np DO NOT ROTATE BY 25% Ng DURING START.

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**THIS MAY BE CAUSED BY:** Improper oil type in cold weather. Excessive drag in aircraft power train. Accessory gearbox internal fault. Turbine wheel rub.



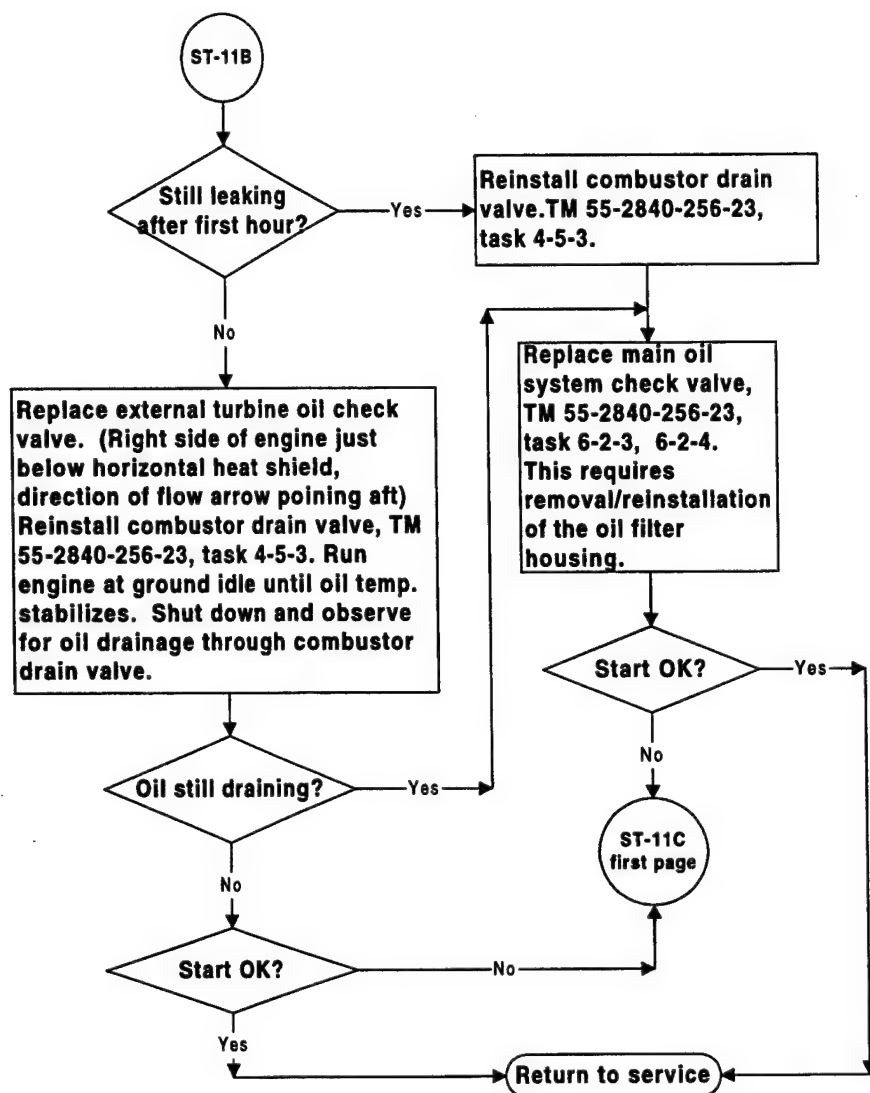
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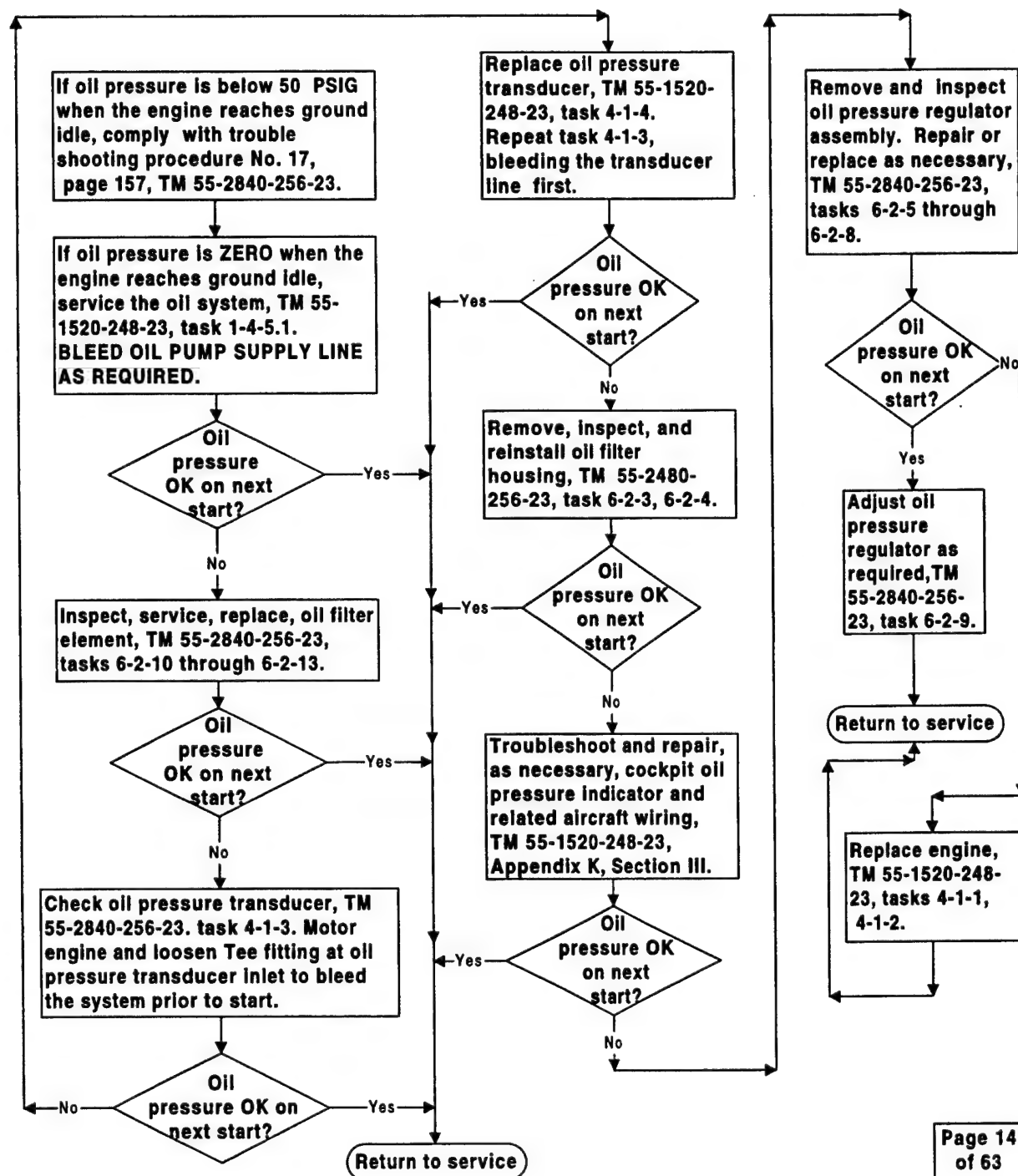
graph TD
    Start([Start]) --> CheckLinkage[Check the fuel control throttle linkage to make certain that the throttle lever is against its minimum stop with twist grip in CUTOFF position, TM 55-2840-256-23, task 7-2-1 and 7-2-6. Adjust rigging as necessary, TM 55-1520-248-23, task 4-6 1.]
    CheckLinkage --> RepairNecessary{Repair necessary?}
    RepairNecessary -- Yes --> StartOK1{Start OK?}
    RepairNecessary -- No --> RemoveValve[Remove, service and reinstall combustor drain valve, TM 55-2840-256-23, tasks 4-5-1, 4-5-2, 4-5-3. Check for oil drainage from the drain port while drain valve is removed.]
    StartOK1 -- Yes --> ReturnService1([Return to service])
    StartOK1 -- No --> StartOK2{Start OK?}
    StartOK2 -- Yes --> ReturnService1
    StartOK2 -- No --> RemoveIgnLead[Remove and test Ignition lead, TM 55-2840-256-23, tasks 8-5-1, 8-5-2. Replace if faulty.]
    RemoveIgnLead --> FiringRateOK1{Firing rate OK?}
    FiringRateOK1 -- Yes --> StartOK3{Start OK?}
    FiringRateOK1 -- No --> RemoveIgnLead
    StartOK3 -- Yes --> ReturnService1
    StartOK3 -- No --> RemoveSparkIgniter[Remove and inspect spark igniter, TM 55-2830-256-23, tasks 8-4-1, 8-4-2. Replace if necessary.]
    RemoveSparkIgniter --> StartOK4{Start OK?}
    StartOK4 -- Yes --> ReturnService1
    StartOK4 -- No --> RemoveFuelNozzle[Remove and inspect fuel nozzle, TM 55-2840-256-23, tasks 7-4-1 through 7-4-5. (Omit step 7.a of 7-4-3, inspection of combustion liner) Repair or replace nozzle as necessary. Select nozzle spacers to provide as close to the maximum D dimension as possible.]
    RemoveFuelNozzle --> StartOK5{Start OK?}
    StartOK5 -- Yes --> ReturnService1
    StartOK5 -- No --> ReplaceEngine[Replace engine, TM 55-1520-248-23, tasks 4-1-1, 4-1-2.]
    ReplaceEngine --> End([End])

    ReturnService1 --> ST11A((ST-11A))
    ST11A --> RunEngine[Run engine at ground idle until oil temp. stabilizes. Shut down and remove combustor drain valve as soon as the engine stops turning. Place a container under the combustor drain port. Measure the oil collected after one hour and again after two hours.]
    RunEngine --> ST11B((ST-11B next page))
    ST11B --> End

    RunEngine --> OilDrainage{Oil drainage?}
    OilDrainage -- Yes --> ST11C((ST-11C))
    OilDrainage -- No --> TestExciter[Test ignition exciter, TM 55-2840-356-23, task 8-2-1.]
    TestExciter --> FiringRateOK2{Firing rate OK?}
    FiringRateOK2 -- Yes --> StartOK6{Start OK?}
    FiringRateOK2 -- No --> ReplaceExciter[Replace ignition exciter, TM 55-2840-256-23, tasks 8-2-2, 8-2-3.]
    StartOK6 -- Yes --> ReturnService1
    StartOK6 -- No --> ReplaceExciter
    ReplaceExciter --> End
  
```



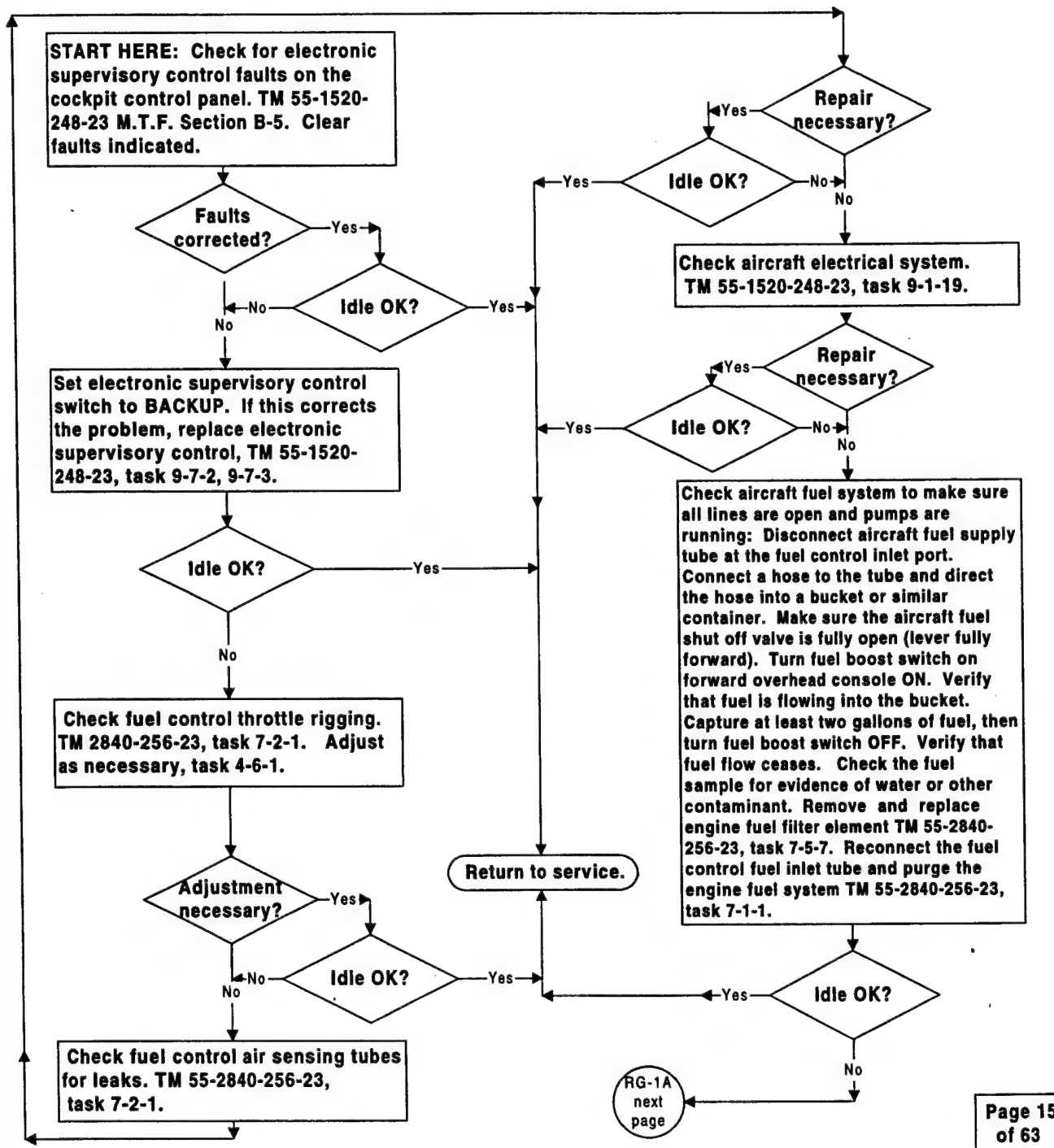
**THIS MAY BE CAUSED BY:** Main oil pump not properly primed. Restriction in oil pump supply line. Low oil level in tank. Dirty oil filter. Faulty aircraft oil pressure sensor or indicator. Leaks within the oil filter housing. Oil pressure regulator sticking. Oil pump or oil pump drive failure. Accessory gearbox problem.

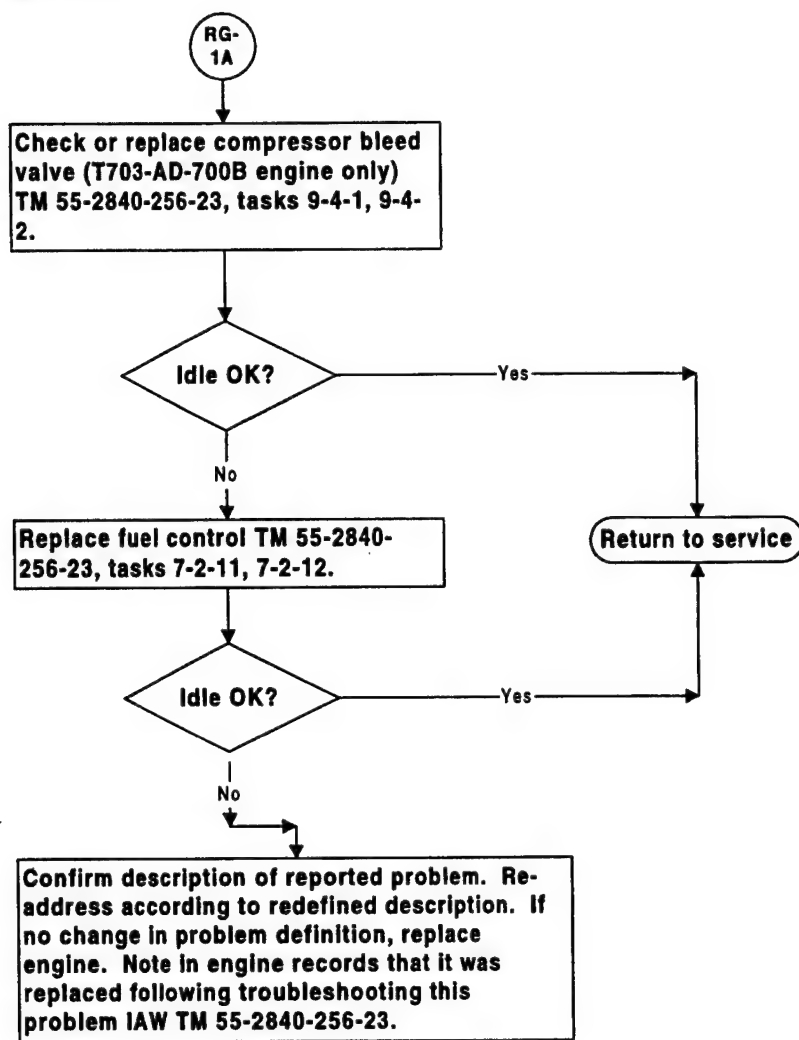


# RG-1 ENGINE SPEED CYCLES (UNSTABLE) AT GROUND IDLE (61-63% Ng).

Page 1 of 2

**THIS MAY BE CAUSED BY:** Fuel control throttle rigging or security. Restriction in fuel supply. Fuel control sensing air tube leak. Fuel control malfunction. Aircraft electrical harness. Electronic supervisory control. Compressor bleed valve (T703-AD-700B engine only).

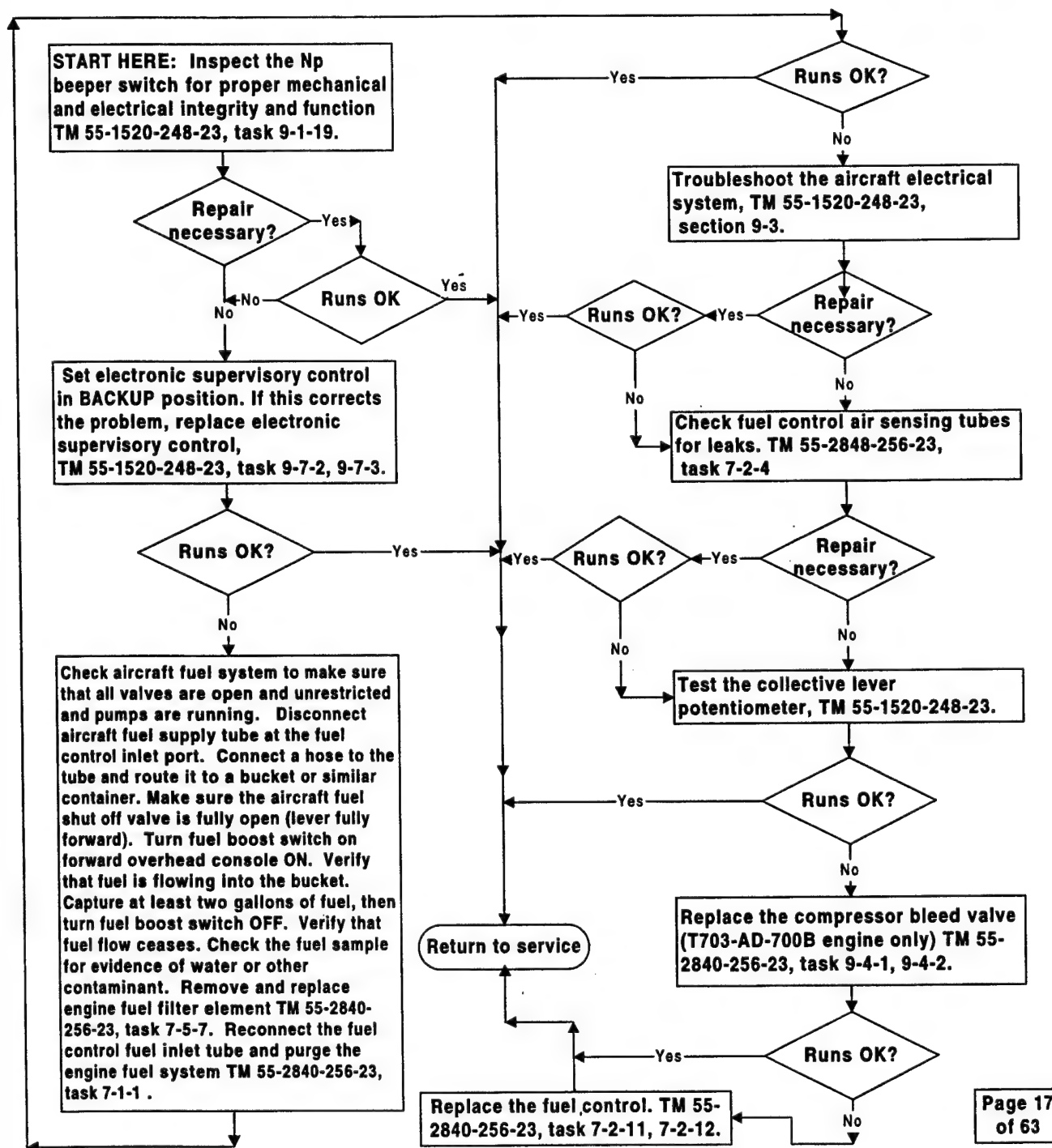






**RG-2. IDLE SPEED CYCLES (UNSTABLE) AT 100% Nr/Np, MAIN ROTOR AT FLAT PITCH (FLIGHT IDLE).** Page 1 of 1

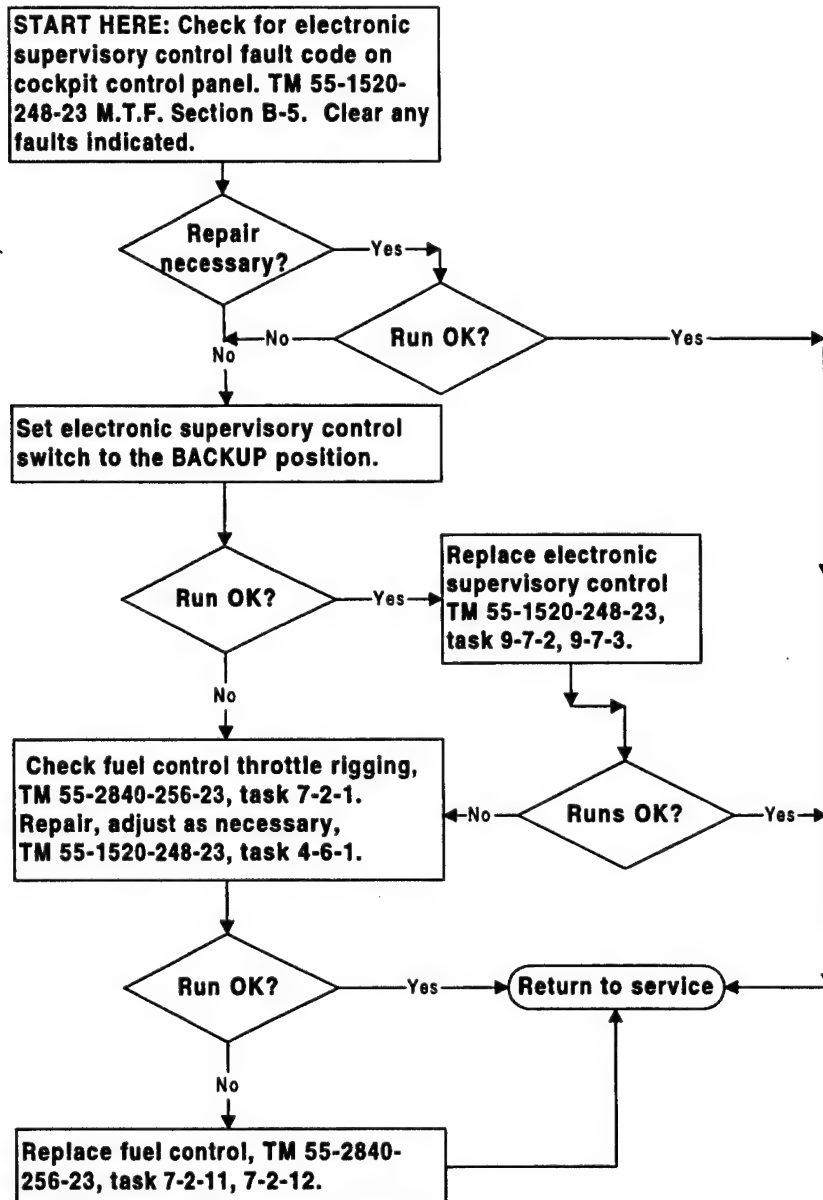
**THIS MAY BE CAUSED BY:** Np beeper switch. Collective pitch position potentiometer. Fuel control throttle rigging or security. Restriction in fuel supply. Aircraft electrical system. Fuel control air sensing tube leaks. Fuel control malfunction. Compressor bleed valve control (T703-AD-700B engine only). Electronic supervisory control.



**RG-3 IDLE SPEED DOES NOT REPEAT TO THE DESIRED SET POINT ON REPEATED THROTTLE MOVEMENTS FROM, AND RETURNING TO, IDLE.**

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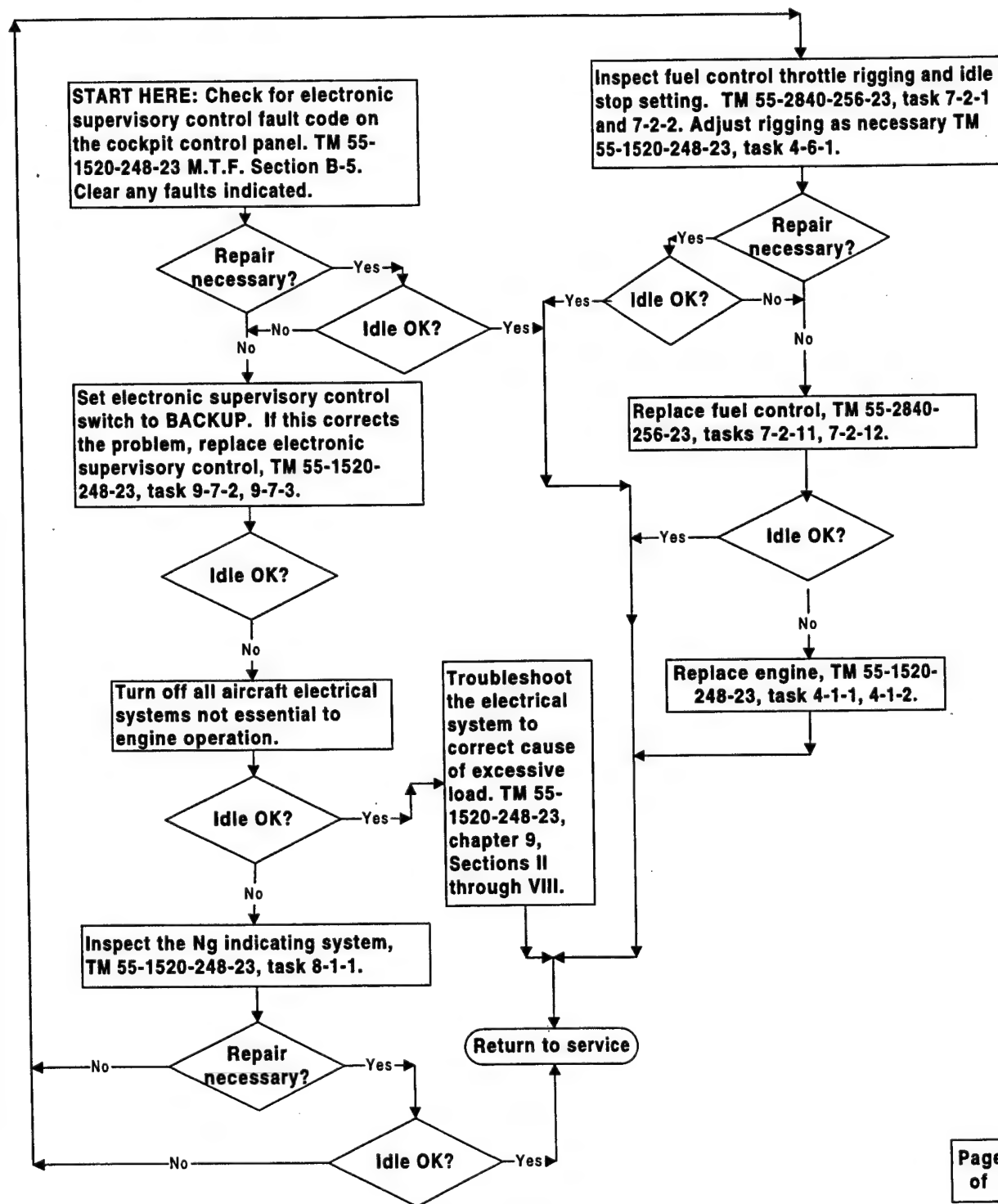
**THIS MAY BE CAUSED BY: Fuel control throttle rigging or security. Fuel control malfunction. Electronic supervisory control.**



# RG-4 IDLE SPEED TOO LOW (SHIFTED LOW FROM PRIOR SETTING).

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**THIS MAY BE CAUSED BY:** Fuel control throttle rigging. Idle speed adjustment improperly set. Ng tachometer error. Excessive generator load (will result in slightly higher TGT). Fuel control malfunction. Electronic supervisory control.

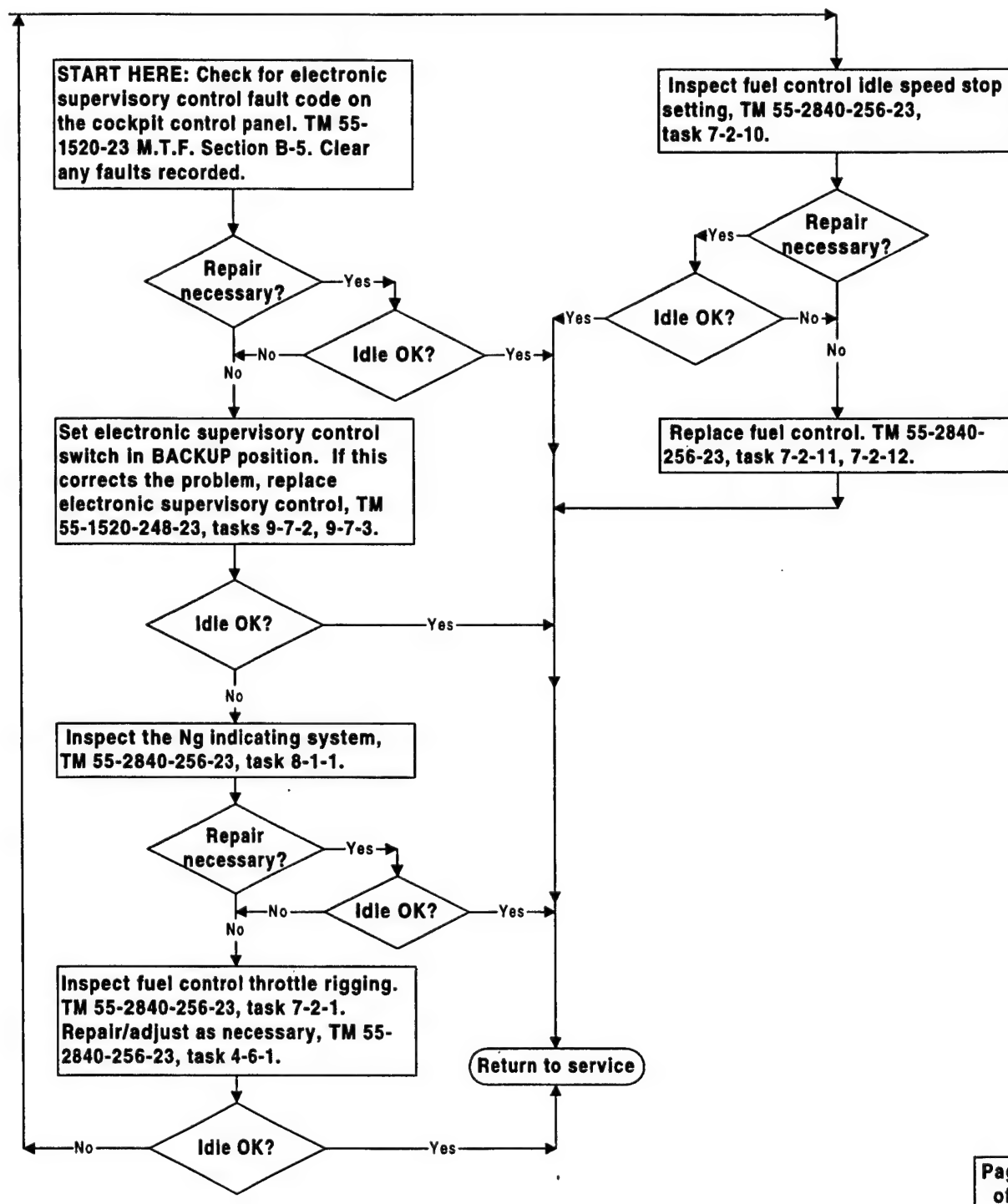


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**RG-5 IDLE SPEED TOO HIGH. WILL NOT RESPOND TO IDLE SPEED DECREASE ADJUSTMENT. MAY RESPOND TO GROSS IDLE SPEED INCREASE ADJUSTMENT.**

**Page 1 of 1**

**THIS MAY BE CAUSED BY: Ng tachometer error. Incorrect fuel control throttle rigging. Incorrect idle speed setting. Fuel control malfunction. Electronic supervisory control.**

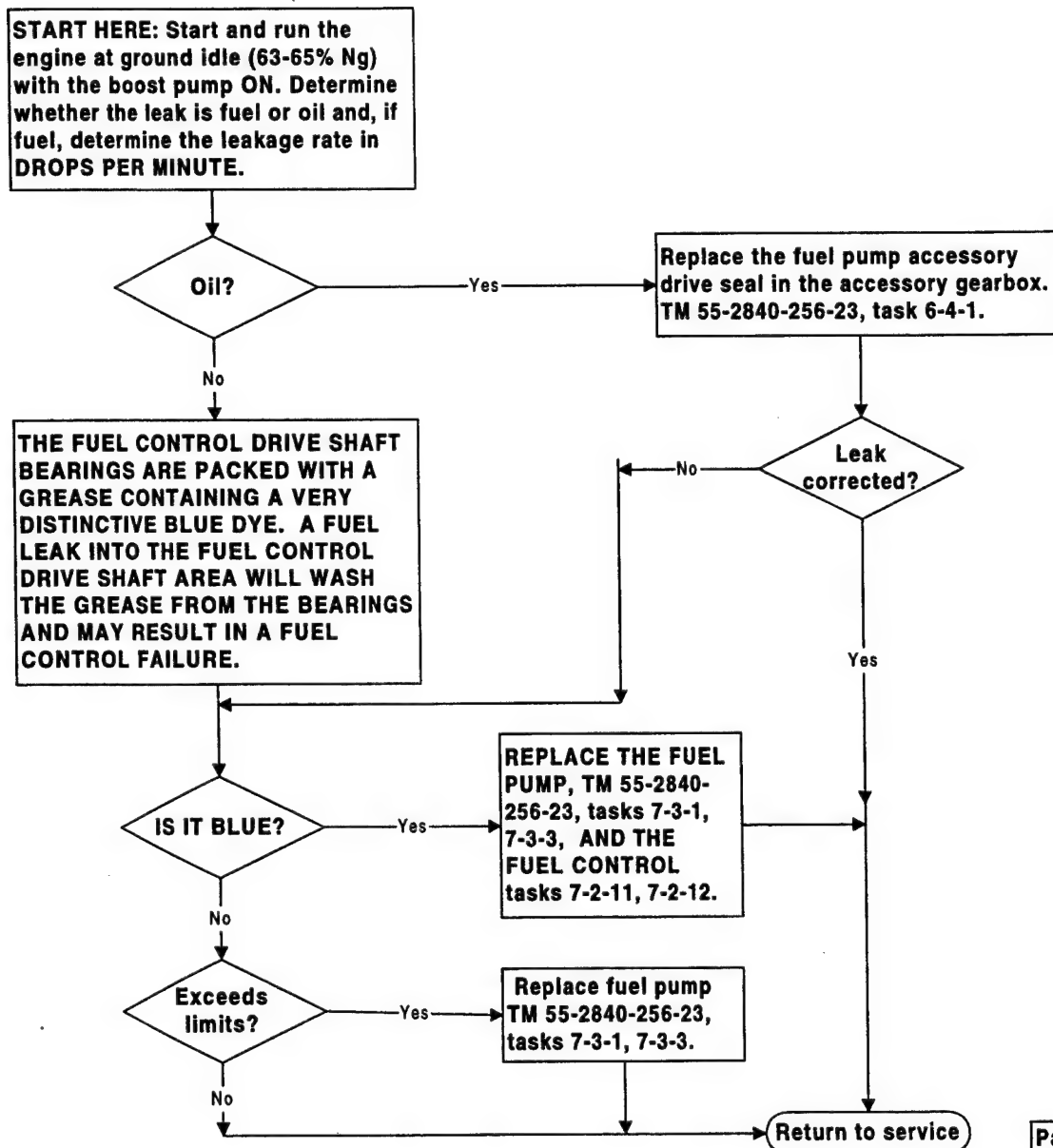


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**RG-6. FUEL AND/OR OIL LEAKING FROM FUEL PUMP/FUEL CONTROL OVERBOARD DRAIN PORTS.**

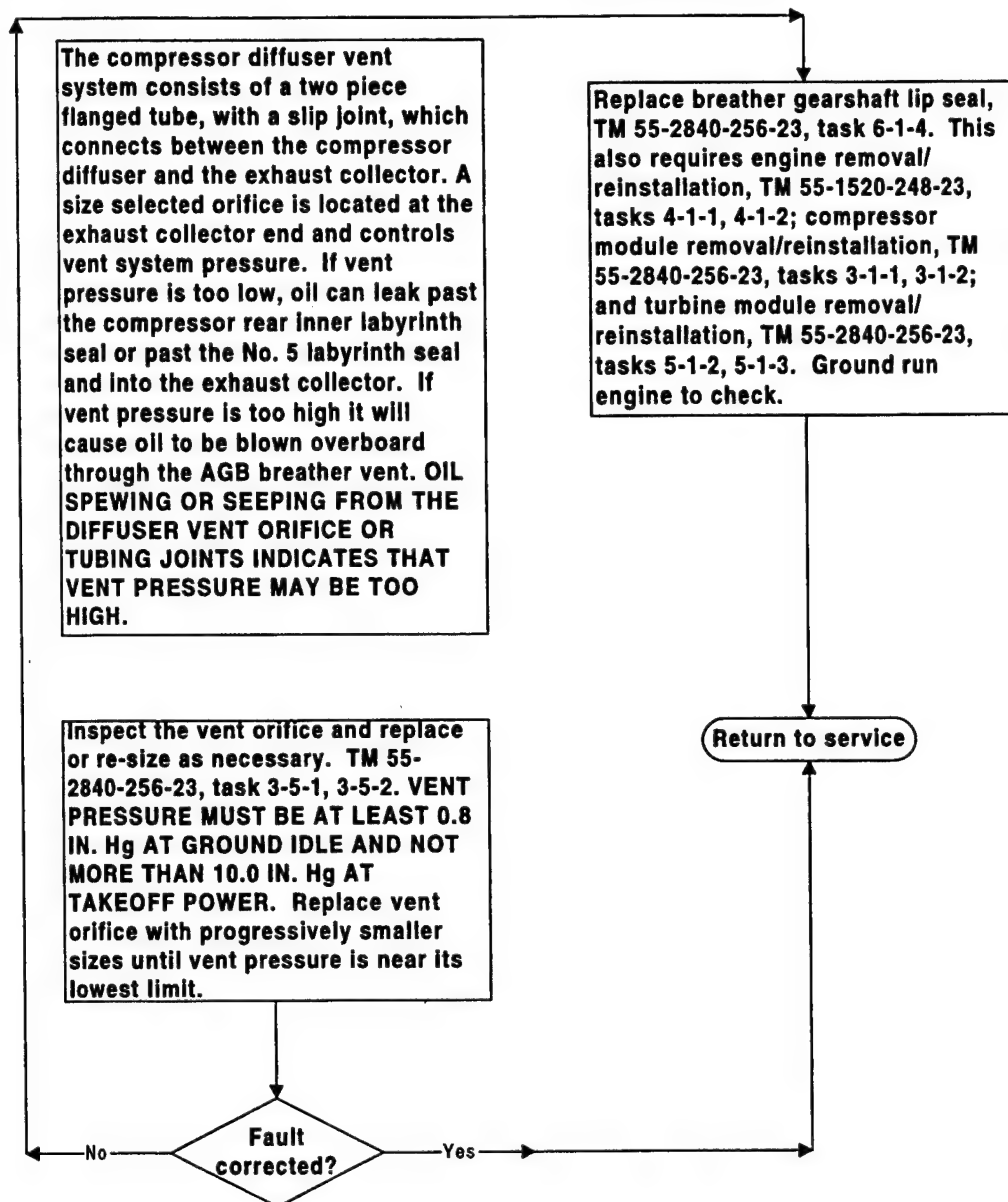
Page 1 of 1

FUEL LEAKAGE FROM THE FUEL CONTROL SEAL DRAIN IS PERMISSIBLE UP TO TEN DROPS PER MINUTE. EXCESSIVE FUEL LEAKAGE IS CAUSED BY A FAULTY FUEL PUMP TO FUEL CONTROL DRIVE SHAFT SEAL. OIL LEAKAGE IS CAUSED BY A FAULTY GEARBOX TO FUEL PUMP SEAL. THE FUEL CONTROL DRAIN (FUEL) AND THE FUEL PUMP DRAIN (OIL) ARE BOTH CONNECTED TO THIS COMMON DRAIN PORT.



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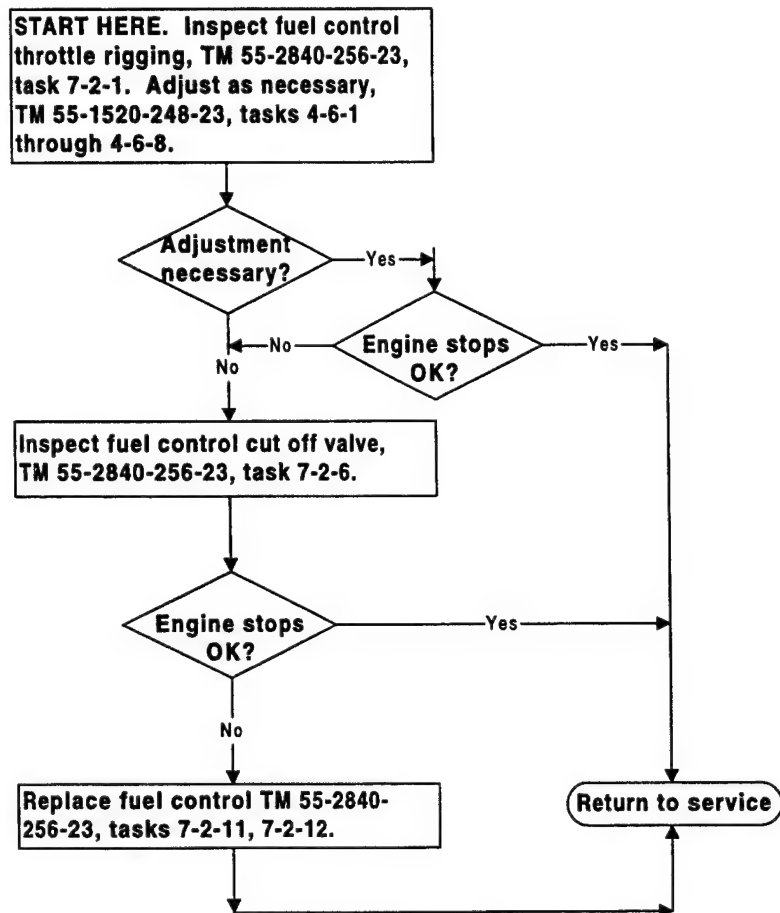
**This is usually caused by an improperly sized vent orifice. However a leaking breather gearshaft lip seal can also be the cause.**



**RG-8 UNABLE TO STOP ENGINE WITH FUEL CONTROL THROTTLE  
MOVEMENT TO CUT OFF.**

**Page 1 of 1**

**THIS MAY BE CAUSED BY:** Fuel control throttle rigging or security. Separation of the throttle to cut off valve linkage on the fuel control. Fuel control cut off valve internal failure.



```

graph TD
    Start(( )) --> Box1[THESE SEALS ARE:  
Np output, front  
Np output, rear  
Ng starter generator drive  
Ng tachometer drive  
Np tachometer drive  
Ng spare drive, front  
Np spare drive, rear  
Ng fuel pump/fuel control  
PMA drive  
AGB breather gear]
    Box1 --> D1{Np out, front or rear, leaking?}
    D1 -- Yes --> Box2[Ref. TM 55-2840-256-23 task 6-1-4 for identification and location of these seals. These seals leaking will usually cause an increase in transmission oil level. Visual indications are obscured by the free wheeling unit. Replace these seals, TM 55-1520-248-23, task 4-1-8. This also requires: Forward fairing removal/reinstallation, task 2-1-21. Air induction cowl removal/reinstall, tasks 4-2-1, 4-2-3. Engine to transmission drive shaft removal/reinst, task 6-2-2. Forward tail rotor assy drive shaft removal/reinst, task 6-6-1. Freewheeling unit removal/reinst, task 6-5-1, 6-5-7. AC generator assembly removal/reinstallation, tasks 9-4-8, 9-4-9.]
    D1 -- No --> D2{Leak corrected?}
    D2 -- Yes --> D3{Leak corrected?}
    D3 -- Yes --> End(( ))
    D3 -- No --> D4{Fuel pump/fuel control drive seal leak?}
    D4 -- Yes --> Box3[Replace drive seal, TM 55-2840-256-23, task 6-1-4. This requires fuel pump/control removal/reinstallation, task 7-2-11, 7-2-12, rigging check, task 7-2-1, and fuel system purge, task 7-1-1.]
    D4 -- No --> D5{AGB breather gearbox seal leak?}
    D5 -- Yes --> Box4[Replace AGB breather gearshaft seal, TM 2840-256-23, task 6-1-4. This also requires engine removal/reinstallation as well as compressor and turbine removal/reinstallation, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.]
    D5 -- No --> D6{Leak corrected?}
    D6 -- Yes --> RG10B((RG-10B this page))
    D6 -- No --> D7{Starter generator drive seal leak?}
    D7 -- Yes --> Box5[Replace starter generator drive lip seal, TM 55-2840-256-23, task 6-1-4. This requires starter generator removal/reinstallation, TM 55-1520-248-23, task 9-3-15,]
    D7 -- No --> RG10A((RG-10A this page))
    RG10A --> D2
    RG10B --> D4
    D4 --> D8{Leak corrected?}
    D8 -- Yes --> End2((Return to service))
    D8 -- No --> D9{PMA drive seal leak?}
    D9 -- Yes --> Box6[Replace PMA drive seal, TM 55-2840-256-23, task 6-1-4. (TM tasks for PMA removal/reinst. not written)]
    D9 -- No --> RG10C((RG-10C next page))
    Box6 --> RG10D((RG-10D next page))
    RG10C --> End2
    RG10D --> End2
  
```

**THESE SEALS ARE:**  
 Np output, front  
 Np output, rear  
 Ng starter generator drive  
 Ng tachometer drive  
 Np tachometer drive  
 Ng spare drive, front  
 Np spare drive, rear  
 Ng fuel pump/fuel control  
 PMA drive  
 AGB breather gear

**Np out, front or rear, leaking?**  
 Yes: Ref. TM 55-2840-256-23 task 6-1-4 for identification and location of these seals. These seals leaking will usually cause an increase in transmission oil level. Visual indications are obscured by the free wheeling unit. Replace these seals, TM 55-1520-248-23, task 4-1-8. This also requires: Forward fairing removal/reinstallation, task 2-1-21. Air induction cowl removal/reinstall, tasks 4-2-1, 4-2-3. Engine to transmission drive shaft removal/reinst, task 6-2-2. Forward tail rotor assy drive shaft removal/reinst, task 6-6-1. Freewheeling unit removal/reinst, task 6-5-1, 6-5-7. AC generator assembly removal/reinstallation, tasks 9-4-8, 9-4-9.  
 No: Leak corrected?

**Leak corrected?**  
 Yes: Leak corrected?  
 No: Fuel pump/fuel control drive seal leak?

**Fuel pump/fuel control drive seal leak?**  
 Yes: Replace drive seal, TM 55-2840-256-23, task 6-1-4. This requires fuel pump/control removal/reinstallation, task 7-2-11, 7-2-12, rigging check, task 7-2-1, and fuel system purge, task 7-1-1.  
 No: AGB breather gearbox seal leak?

**AGB breather gearbox seal leak?**  
 Yes: Replace AGB breather gearshaft seal, TM 2840-256-23, task 6-1-4. This also requires engine removal/reinstallation as well as compressor and turbine removal/reinstallation, tasks 3-1-1, 3-1-2, 5-1-2, 5-1-3.  
 No: Leak corrected?

**Leak corrected?**  
 Yes: RG-10B this page  
 No: Starter generator drive seal leak?

**Starter generator drive seal leak?**  
 Yes: Replace starter generator drive lip seal, TM 55-2840-256-23, task 6-1-4. This requires starter generator removal/reinstallation, TM 55-1520-248-23, task 9-3-15,  
 No: RG-10A this page

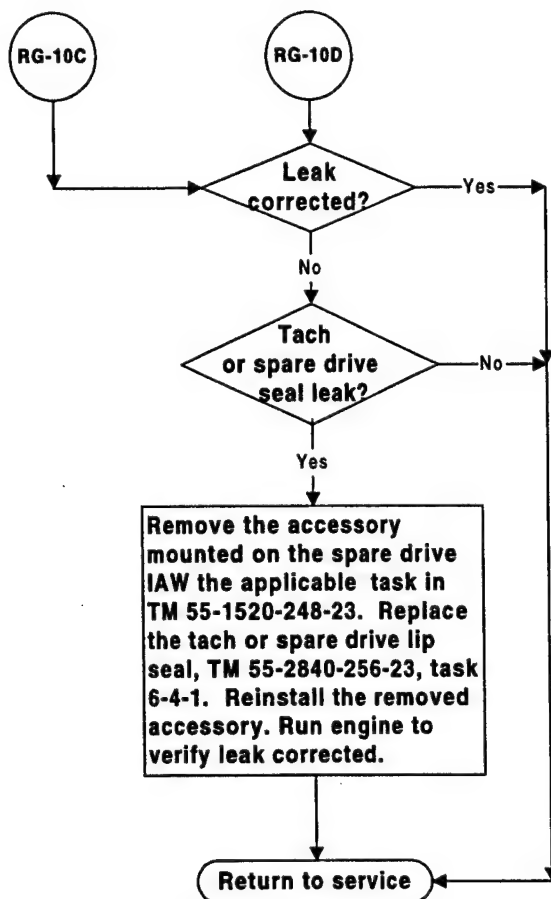
**Leak corrected?**  
 Yes: Return to service  
 No: PMA drive seal leak?

**PMA drive seal leak?**  
 Yes: Replace PMA drive seal, TM 55-2840-256-23, task 6-1-4. (TM tasks for PMA removal/reinst. not written)  
 No: RG-10C next page

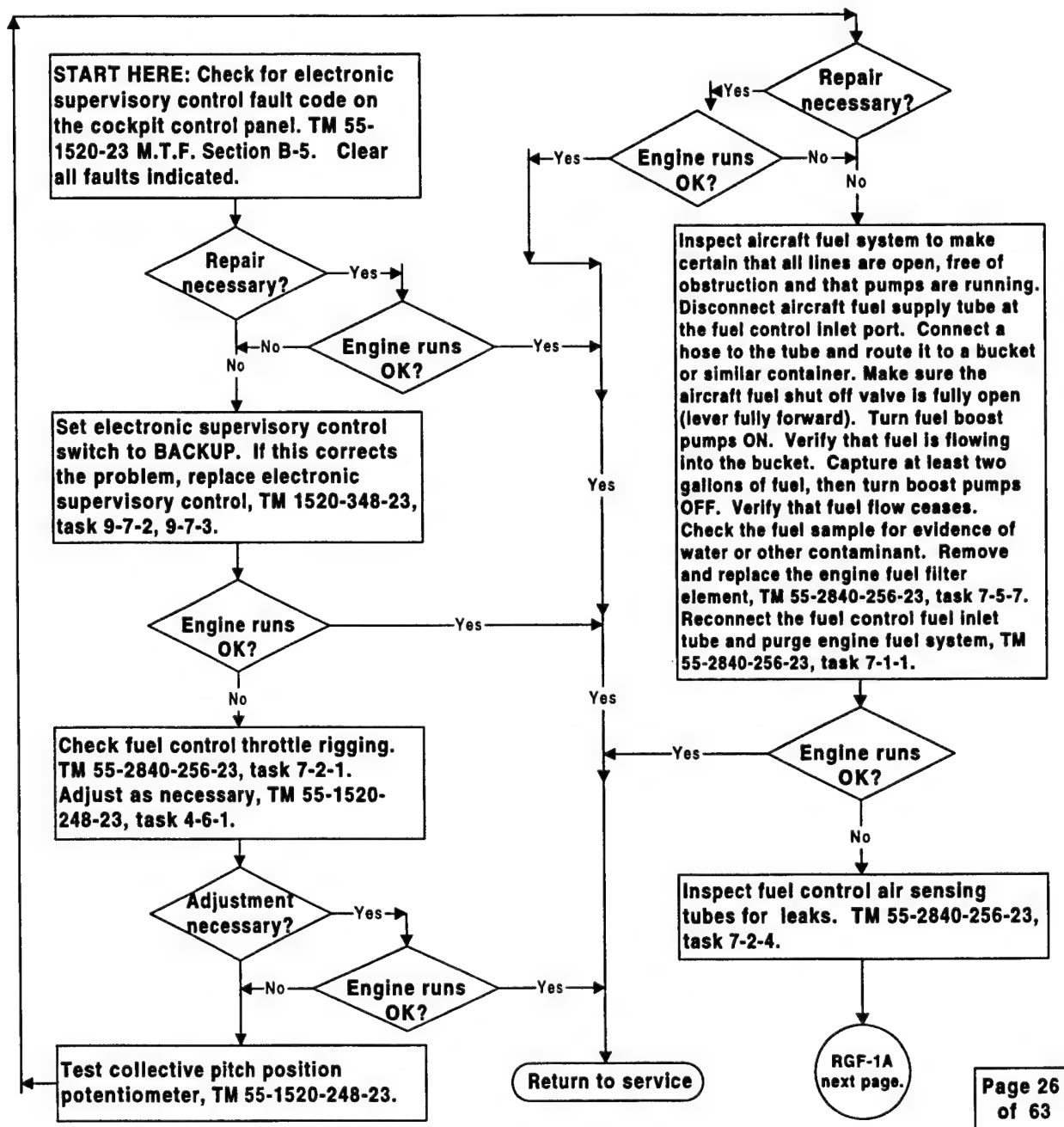
**RG-10D next page**

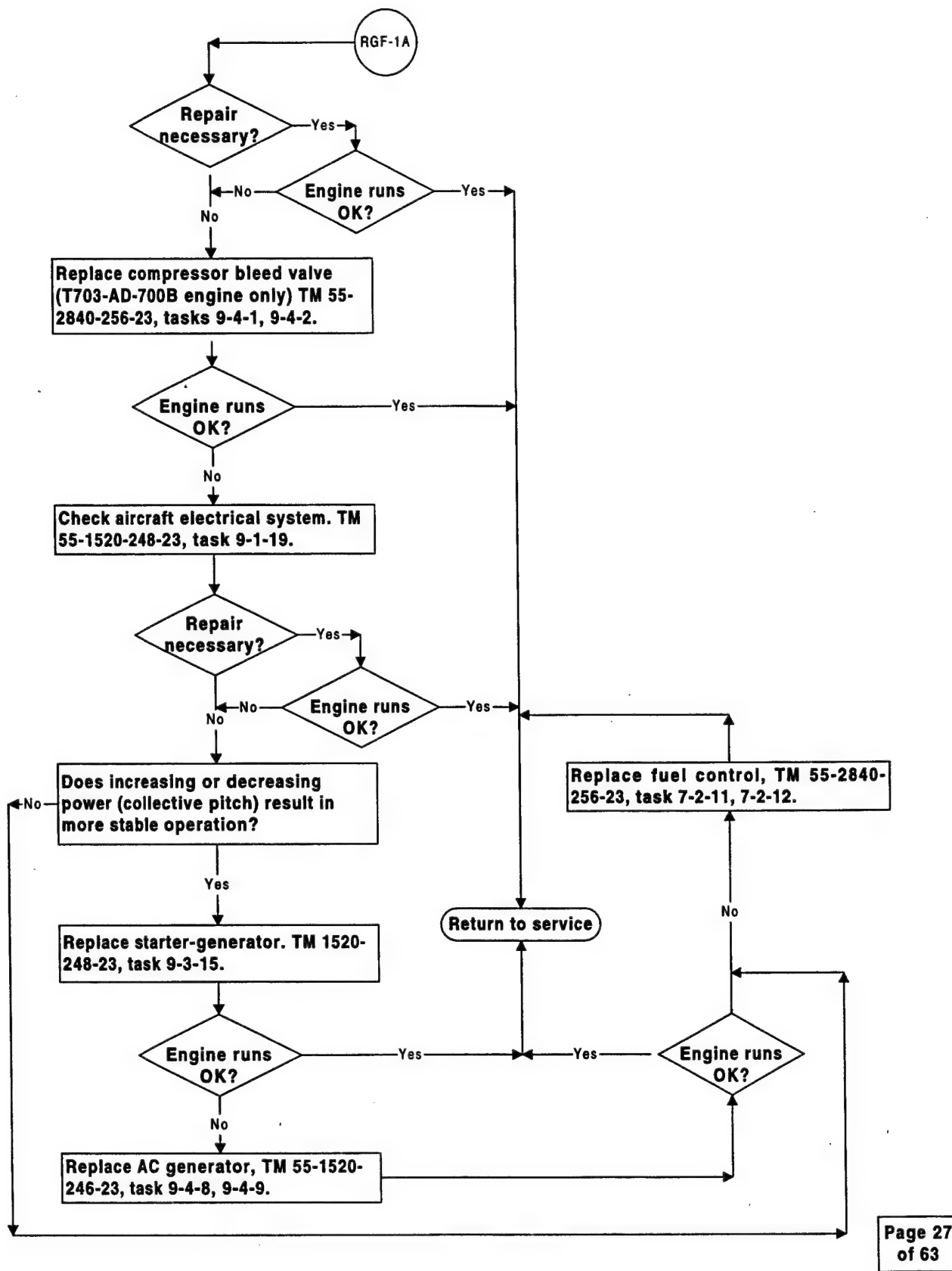
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**THIS MAY BE CAUSED BY:** Collective pitch position potentiometer. Restriction in fuel supply. Fuel control throttle rigging or security. Fuel control air sensing tube leak. Compressor bleed control valve (T703-AD 700B engine only). Aircraft electrical harness. Out of balance condition of the starter generator creating a vibration frequency which upsets the fuel control governing function. Fuel control malfunction. Electronic supervisory control.

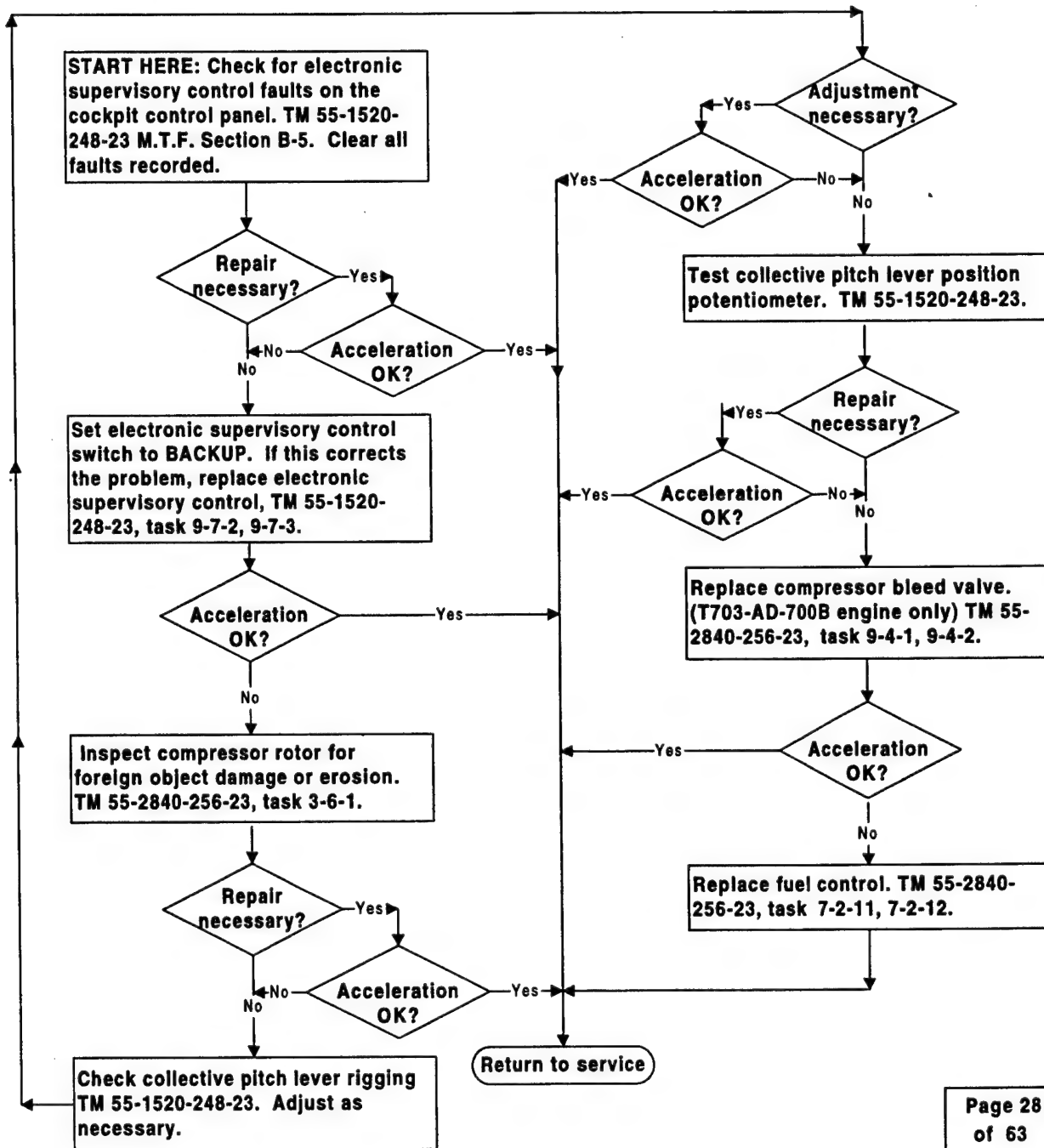




# RGF-2. COMPRESSOR SURGES DURING ACCELERATION FROM IDLE TO GOVERNING AT 100% Ng.

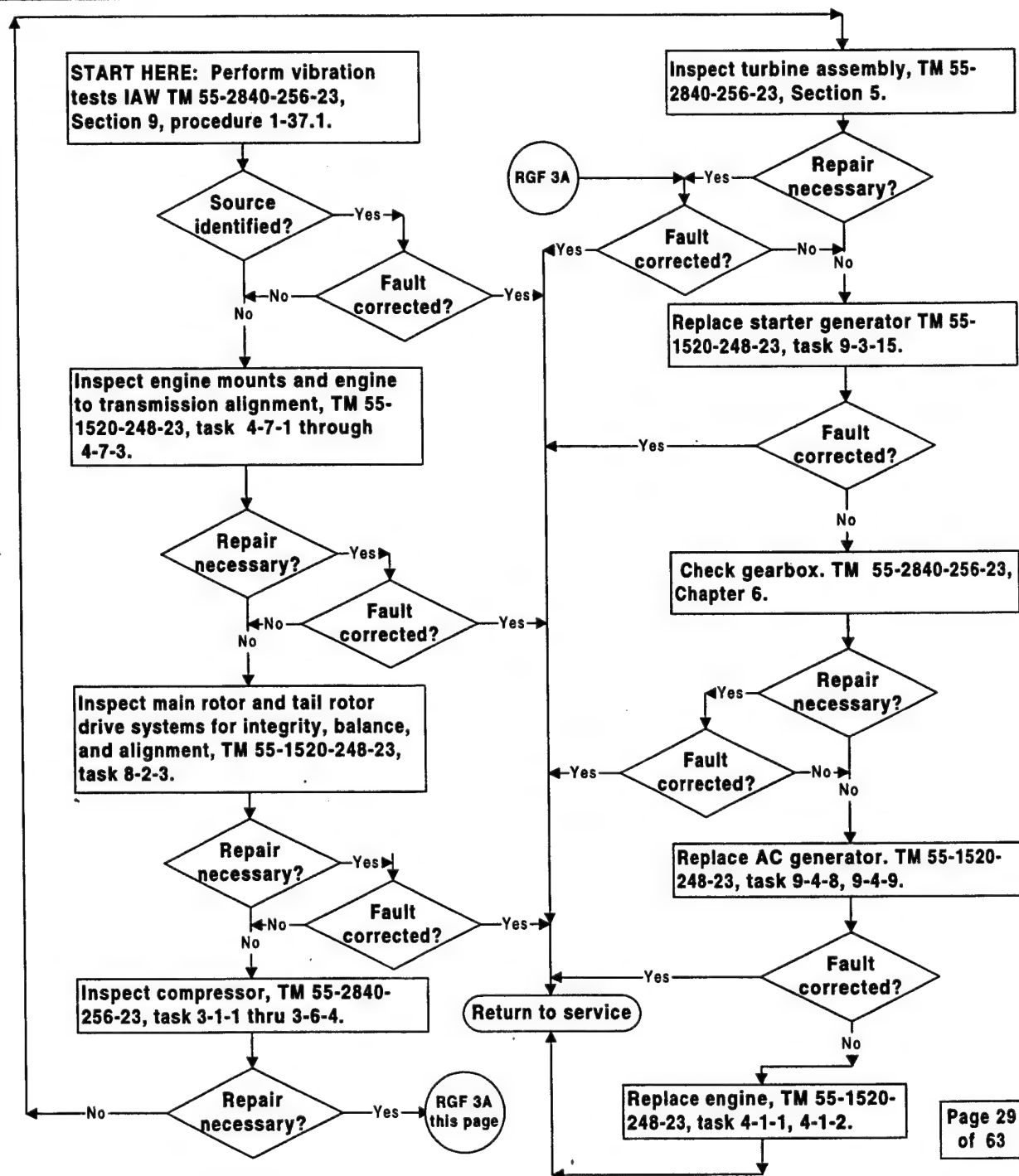
Page 1 of 1

**THIS MAY BE CAUSED BY:** Compressor damage or degradation. Compressor inlet blockage. Pressure-thermal distortion. Bleed valve closing too soon or stuck closed (T703-AD-700B engine only). Gas generator 1st stage nozzle area reduced by blockage from ingested sand and dust deposits. Fuel control. Electronic supervisory control.

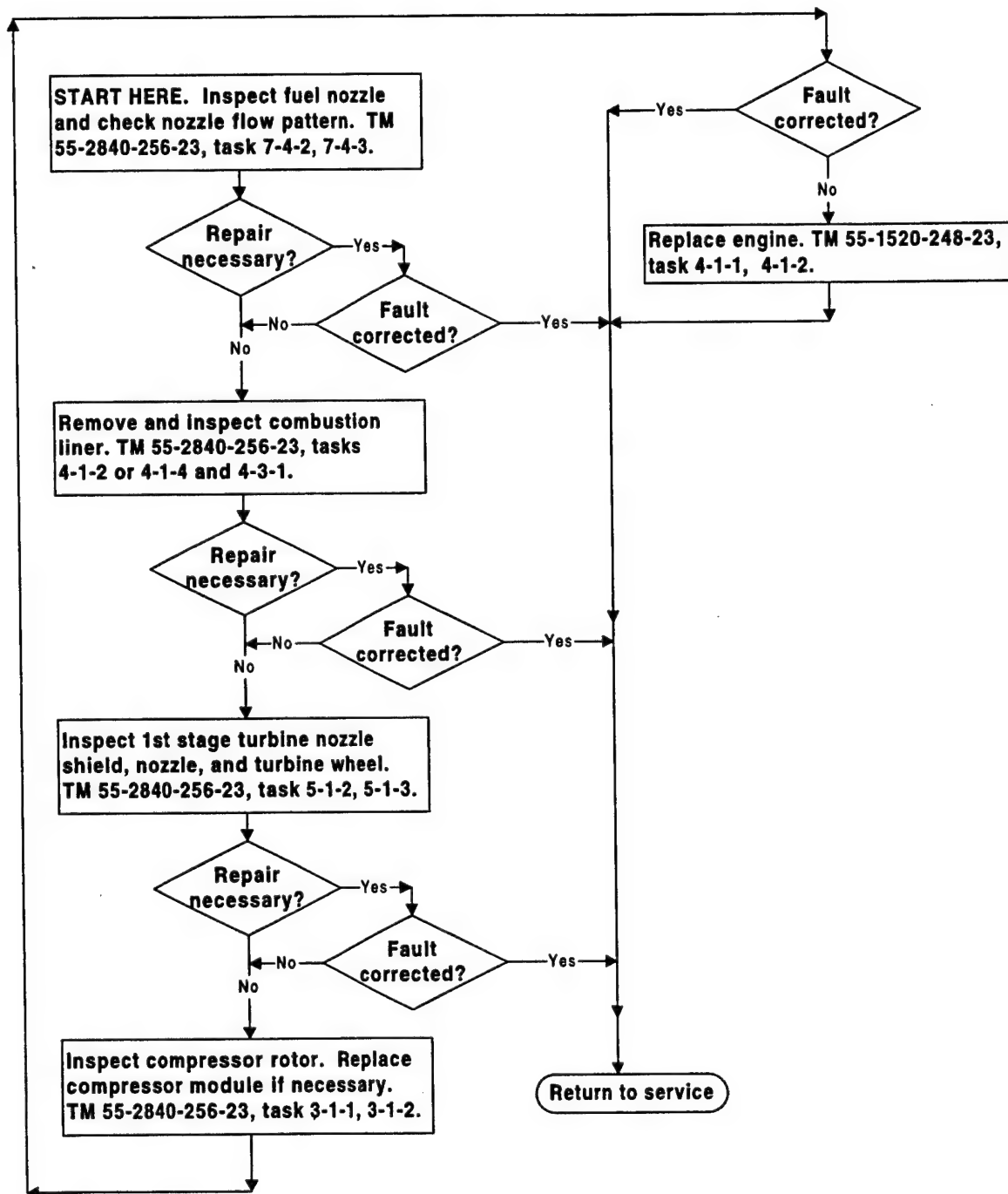


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of 63

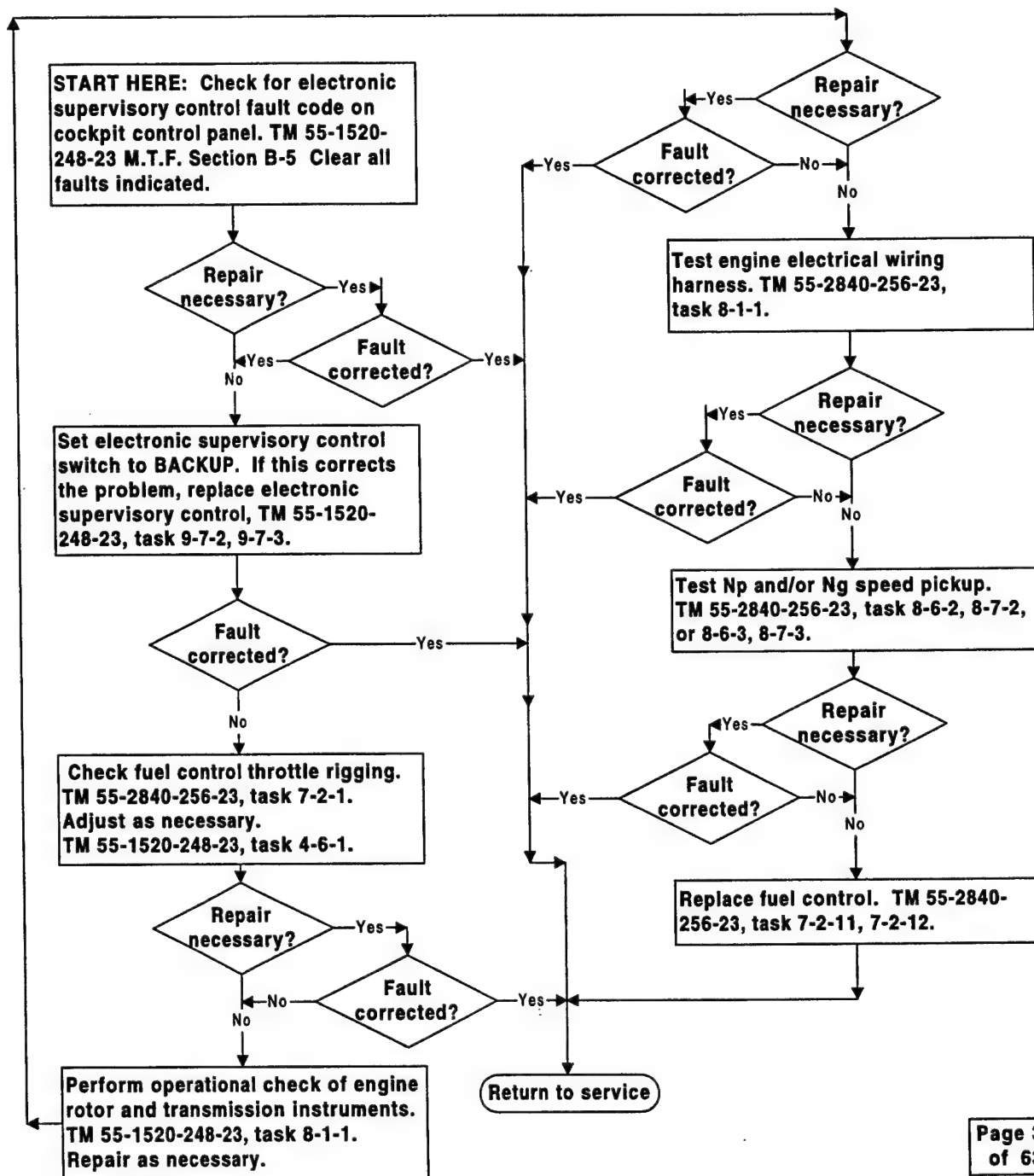
**THIS MAY BE CAUSED BY:** Engine mount looseness. Engine alignment. Main rotor or tail rotor drive systems. Damage or failure of compressor rotor. GGT or PT rotor. Main or AGB bearings. GG or PT rotor unbalance. Gear failure. Gear tooth match. Accessory unbalance.



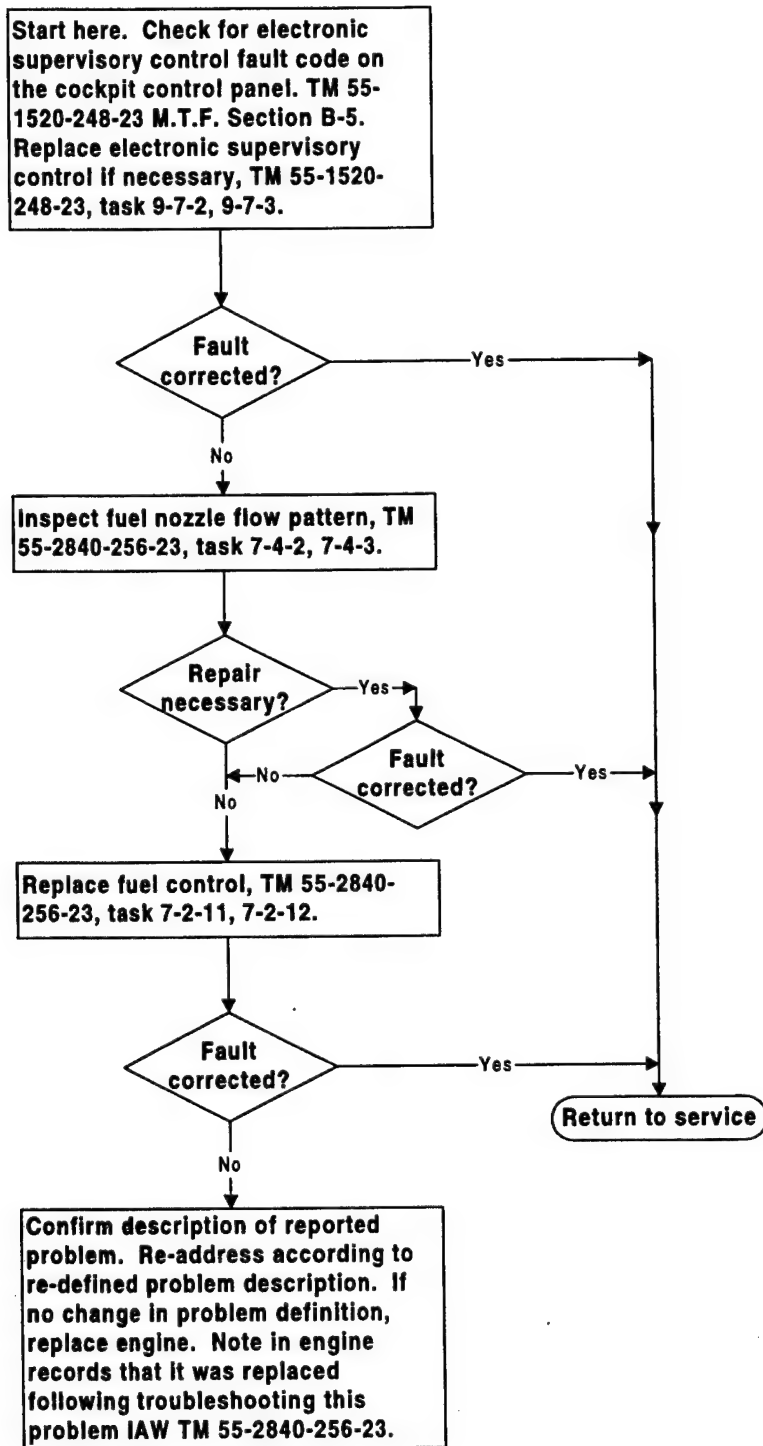
This may be caused by: Combustion liner damage. Turbine damage. Compressor damage. Fuel nozzle.



This may be caused by: Fuel control throttle rigging or security. Speed measurement/indicating systems error. Engine wiring harness. Aircraft to engine wiring harness. Extreme flight maneuver. Output load loss. Fuel control failure. Electronic supervisory control.

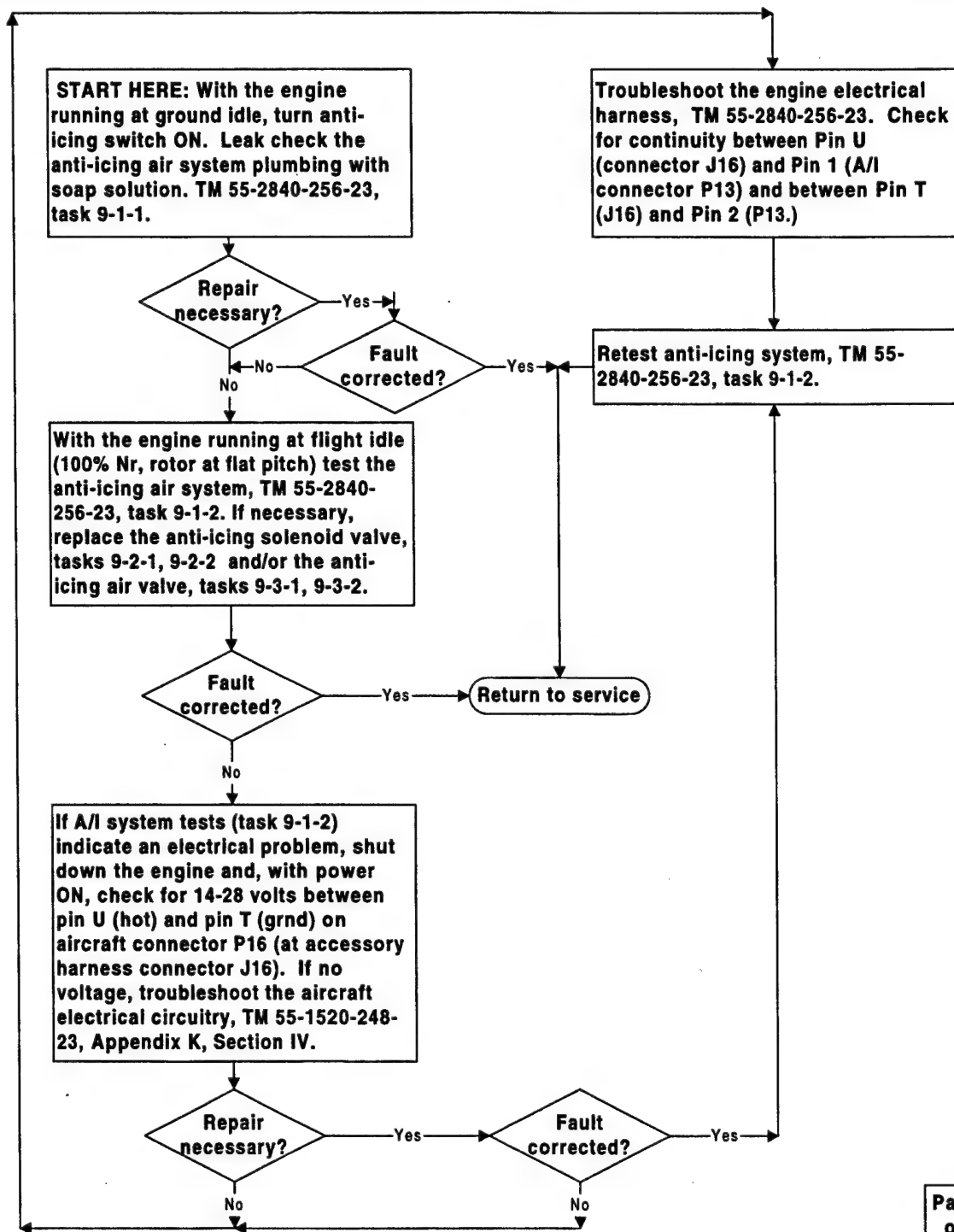


**THIS MAY BE CAUSED BY: Fuel nozzle. Fuel control. Electronic supervisory control.**

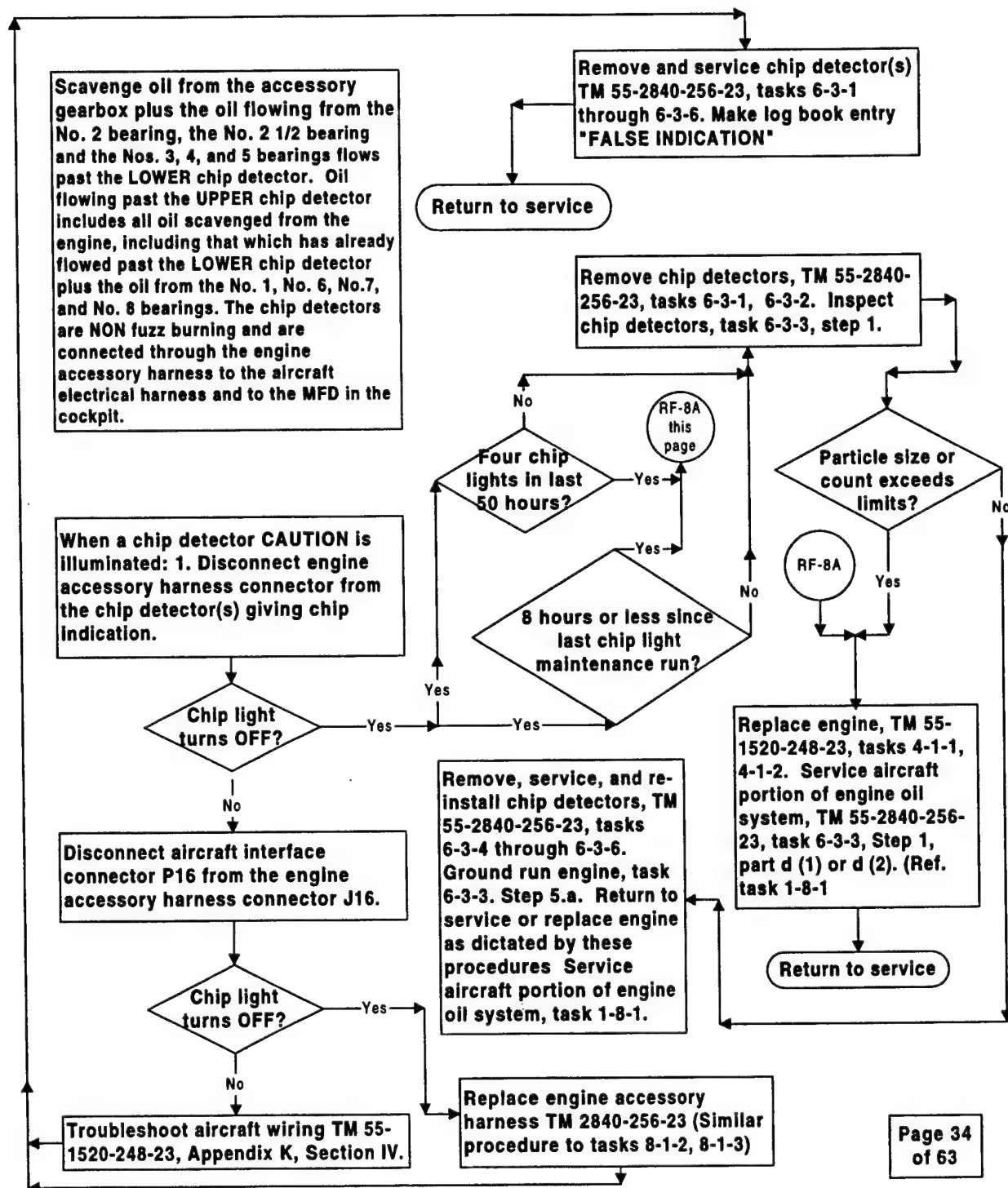




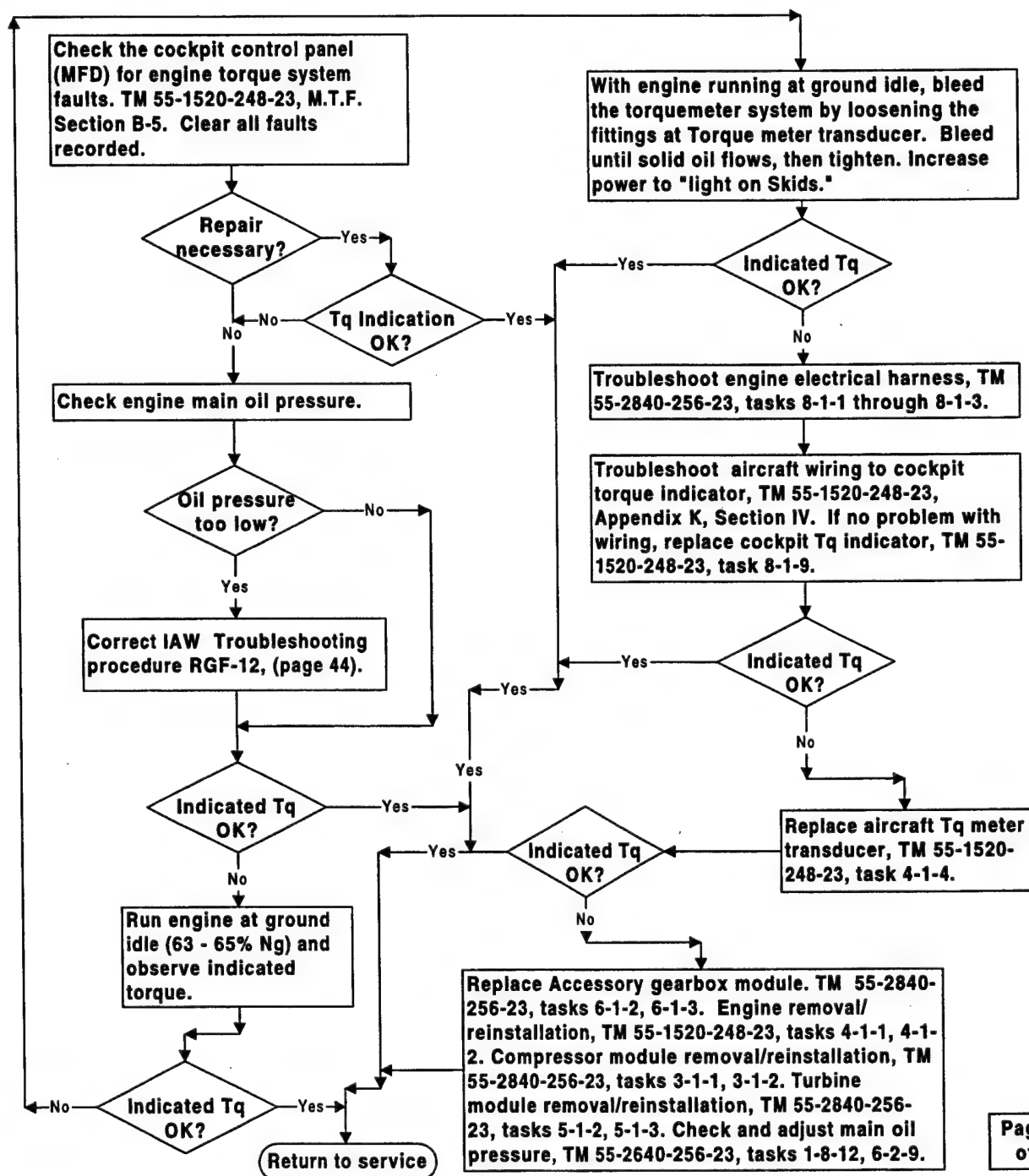
**THIS MAY BE CAUSED BY:** Cracked anti-ice air tube. Defective switch. Plug installed in solenoid valve. Anti-icing air valve stuck closed. Solenoid valve not working. Dirt in vane exit slots. Valve to scroll gasket failed.



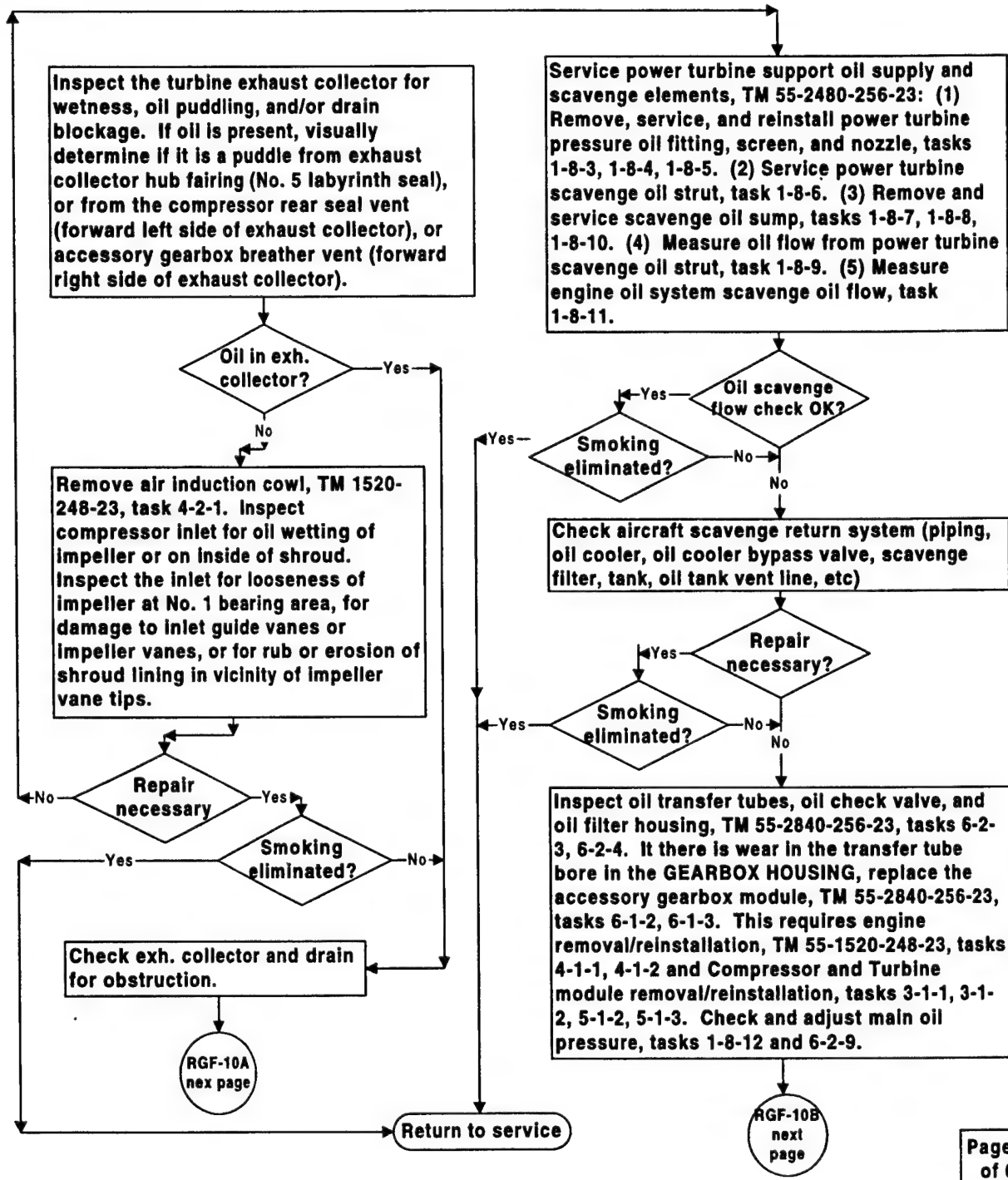
THIS IS INDICATION OF ENGINE METAL GENERATION WHICH MUST BE IDENTIFIED AND CORRECTED.

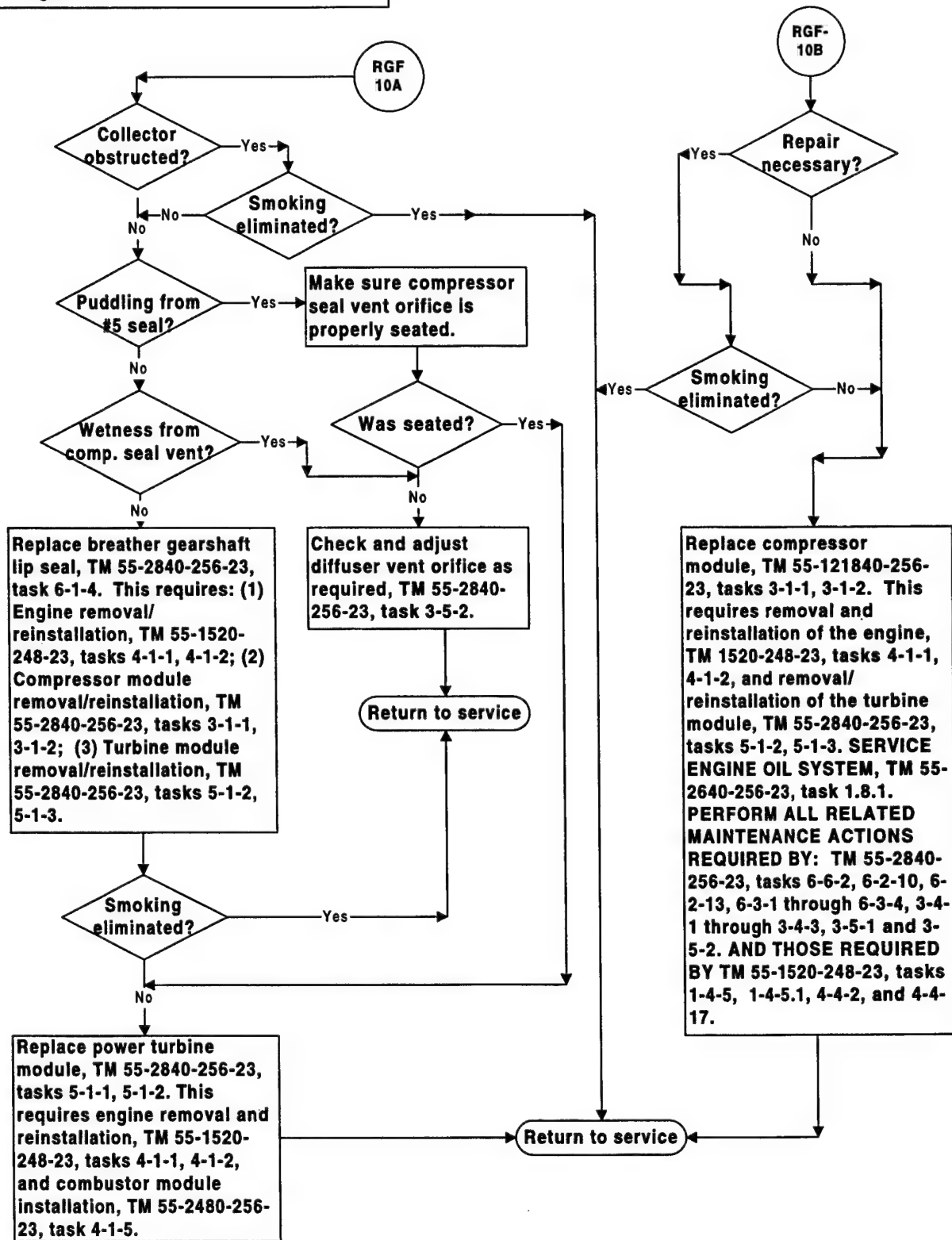

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of 63

**THIS MAY BE CAUSED BY:** Clogged torquemeter bleed orifice. Clogged pressure sensing line. Torque measuring system. Torque transducer or related wiring faulty. Torquemeter supporting bearing failure. Low main oil pressure.



**THIS MAY BE CAUSED BY:** Exhaust collector drain blocked. Restricted power turbine sump scavenge strut. Degraded oil pump. No. 5 seal leak. No. 1 seal leak. Failed No. 1 bearing. Defective turbine seal. AGB breather gear lip seal. Oil transfer tubes. Aircraft scavenging system.

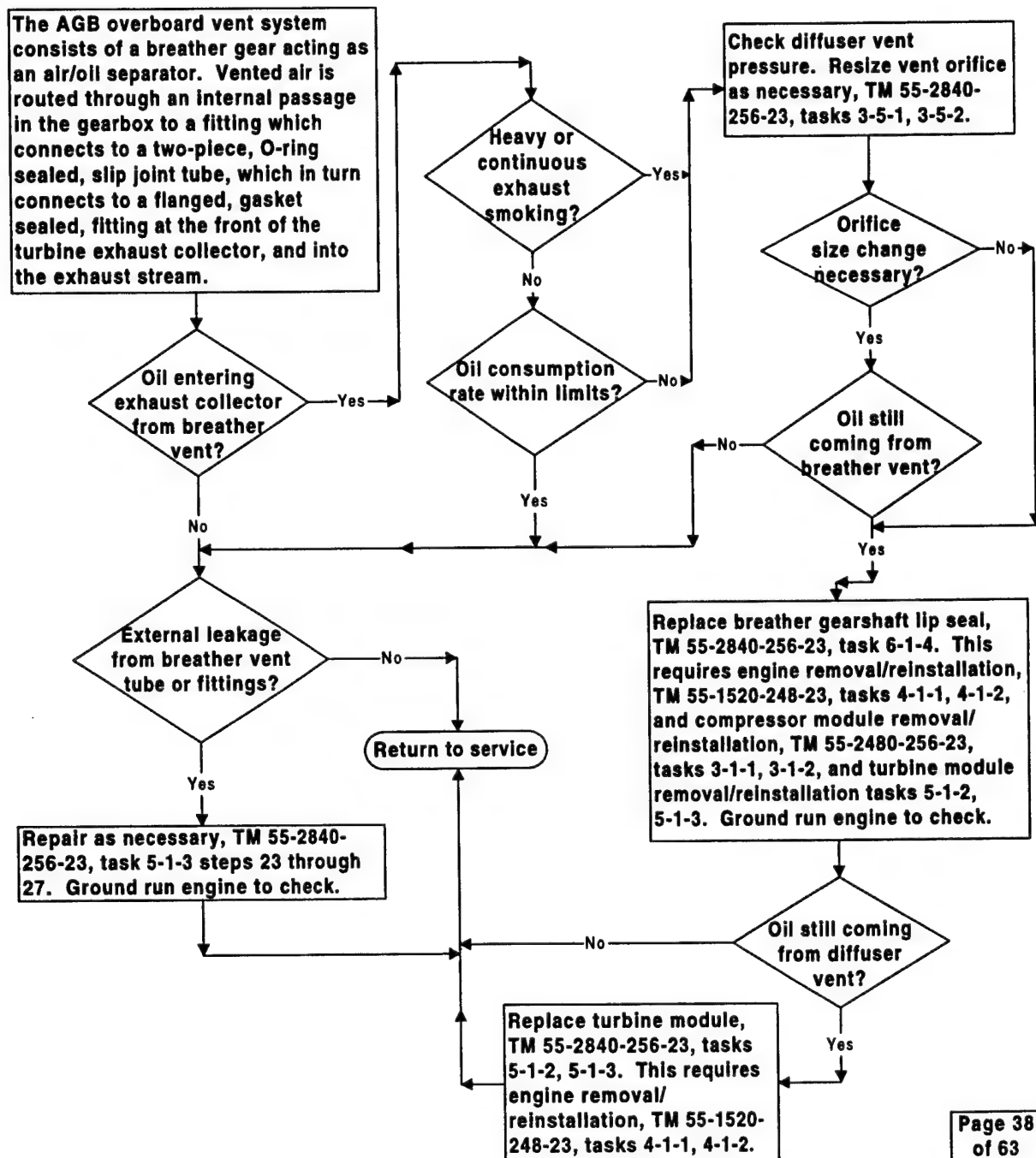




# RGF-11 OIL SPEWING OR LEAKING FROM GEARBOX VENT AND/ OR TUBING JOINTS.

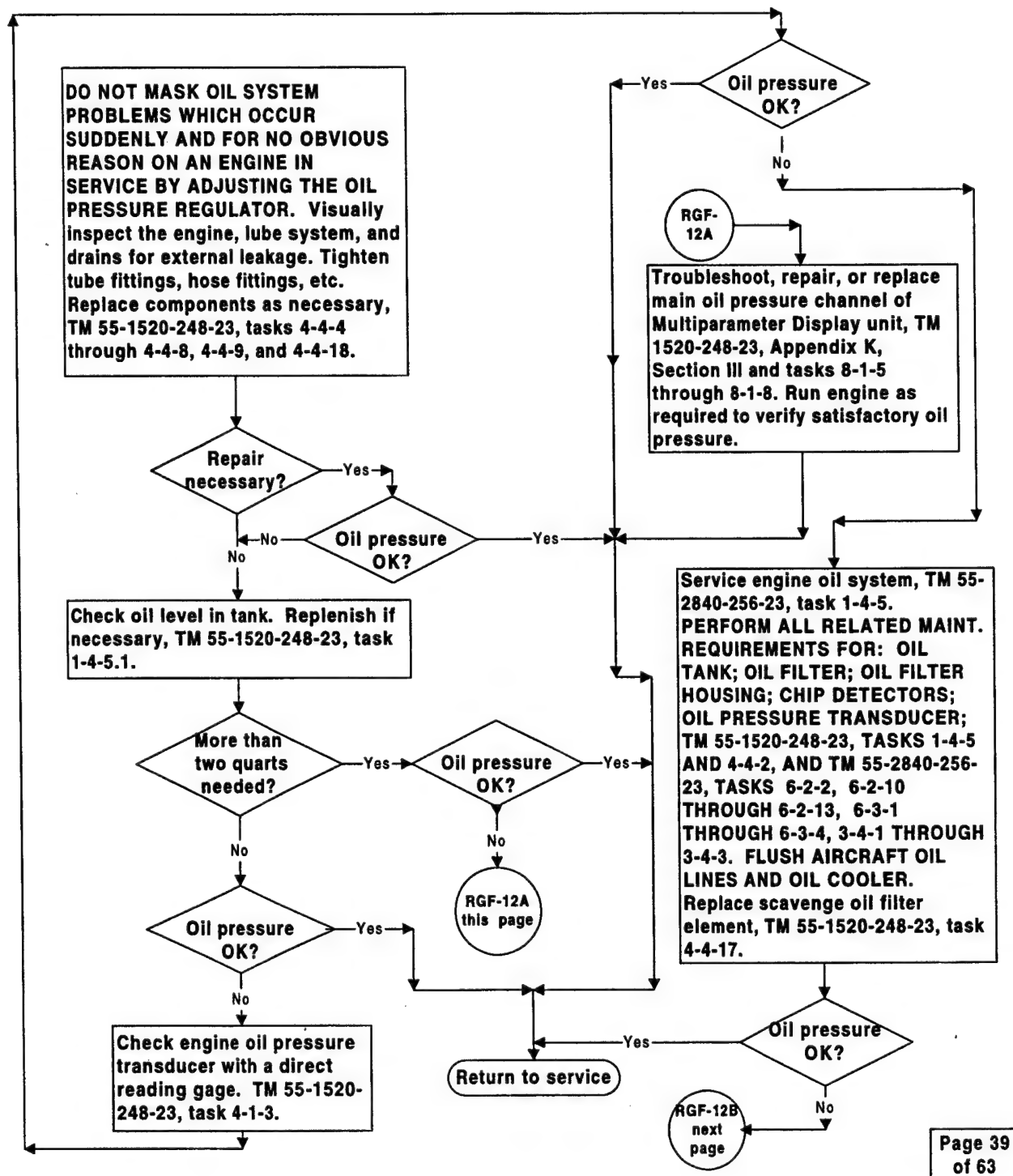
Page 1 of 1

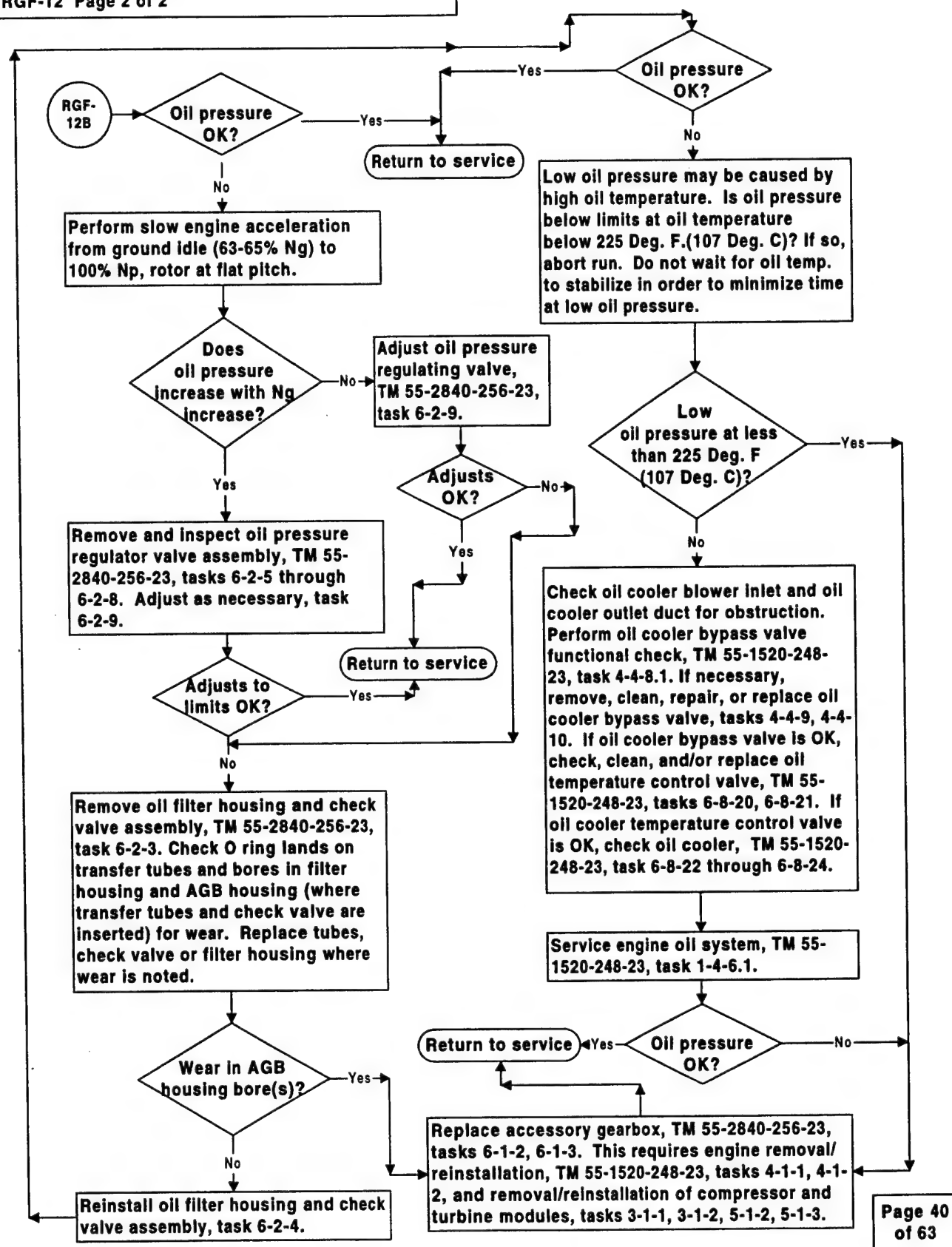
**THIS MAY BE CAUSED BY:** AGB breather gearshaft lip seal leakage. High gearbox pressure caused by diffuser vent orifice too small or damaged. Worn or damaged turbine seals in the cooling air or pressure balance circuits.



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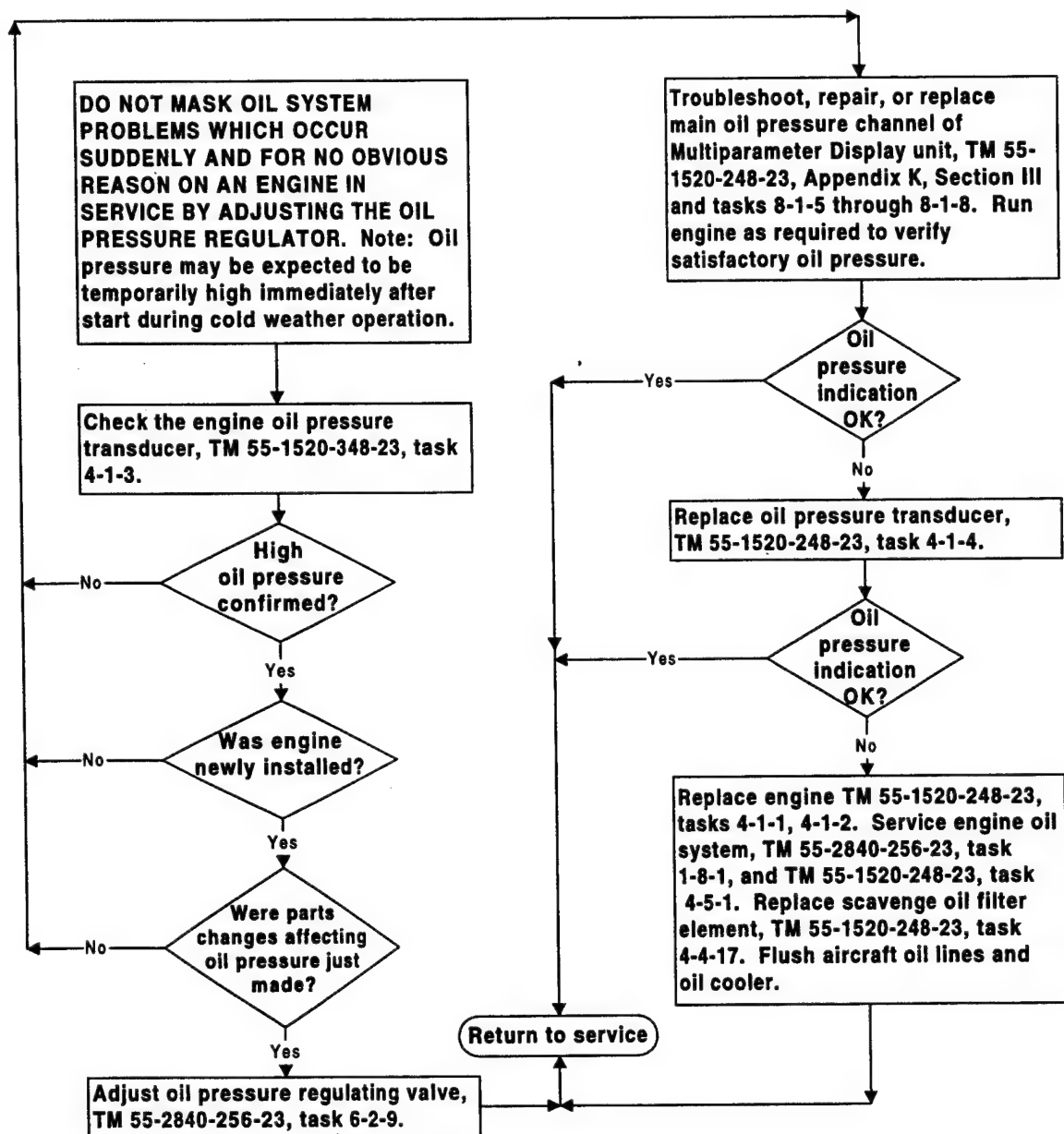
**THIS MAY BE CAUSED BY:** Oil level. Oil pressure measurement system. Oil pressure regulator. Engine oil filter. Degraded oil pump. Contaminated oil. Oil transfer tubes. Other internal oil leak. External leak. Oil supply restriction. High oil temperature.







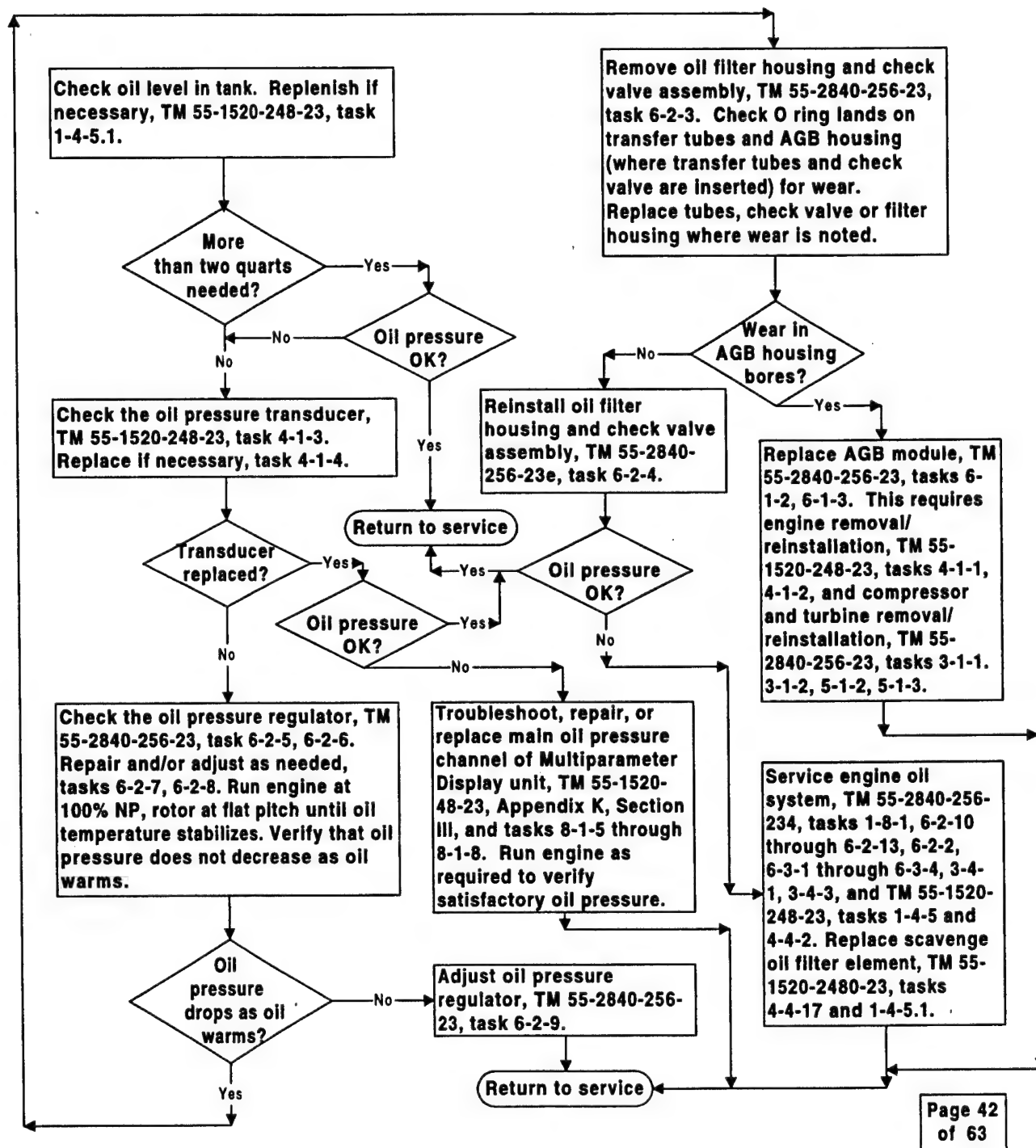
**THIS MAY BE CAUSED BY:** Oil pressure measurement system. Oil passage obstruction in AGB. Turbine oil supply restriction.



# RGF-14 OIL PRESSURE DROPS OFF SEVERELY WITH NORMAL OIL TEMPERATURE.

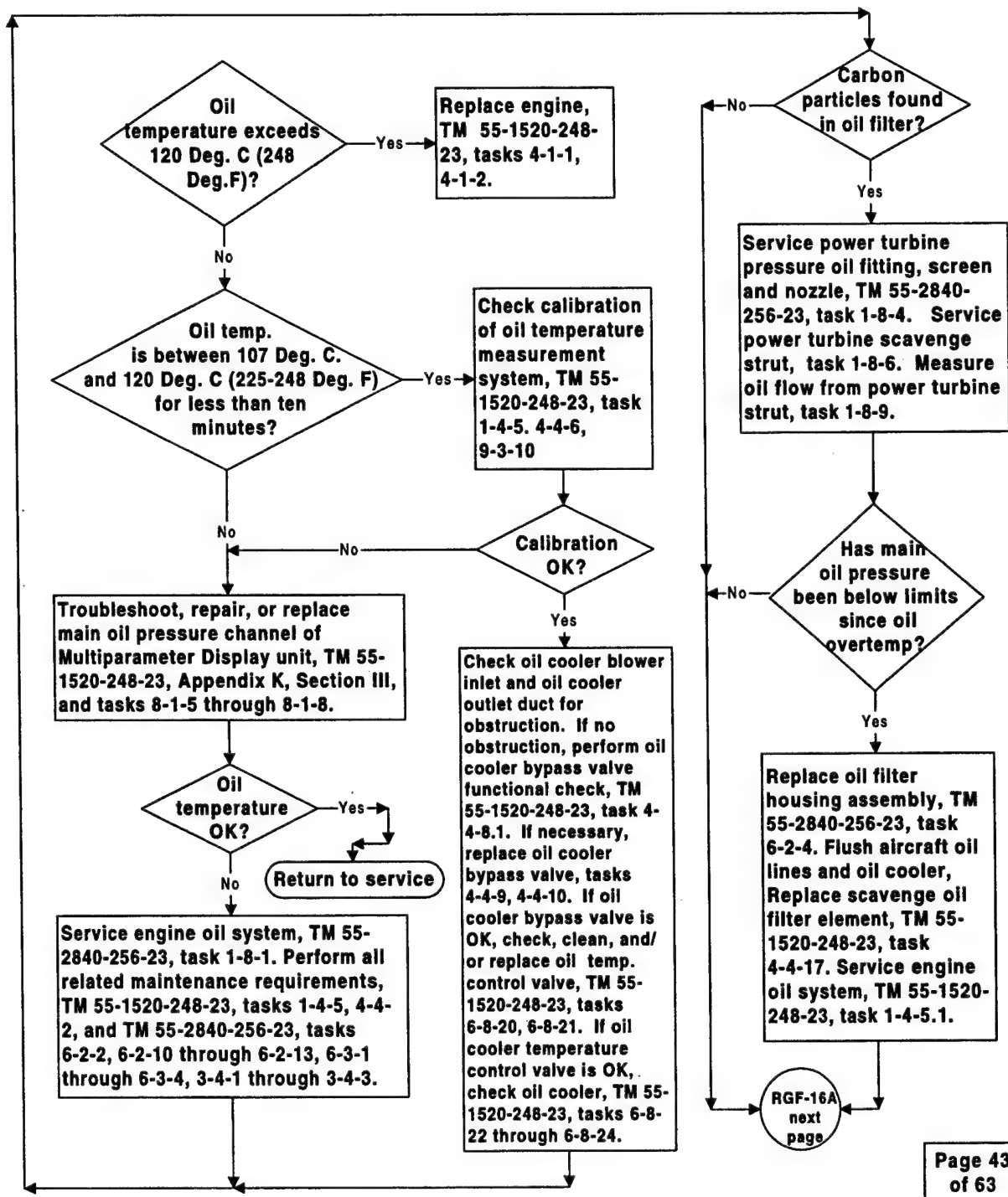
Page 1 of 1

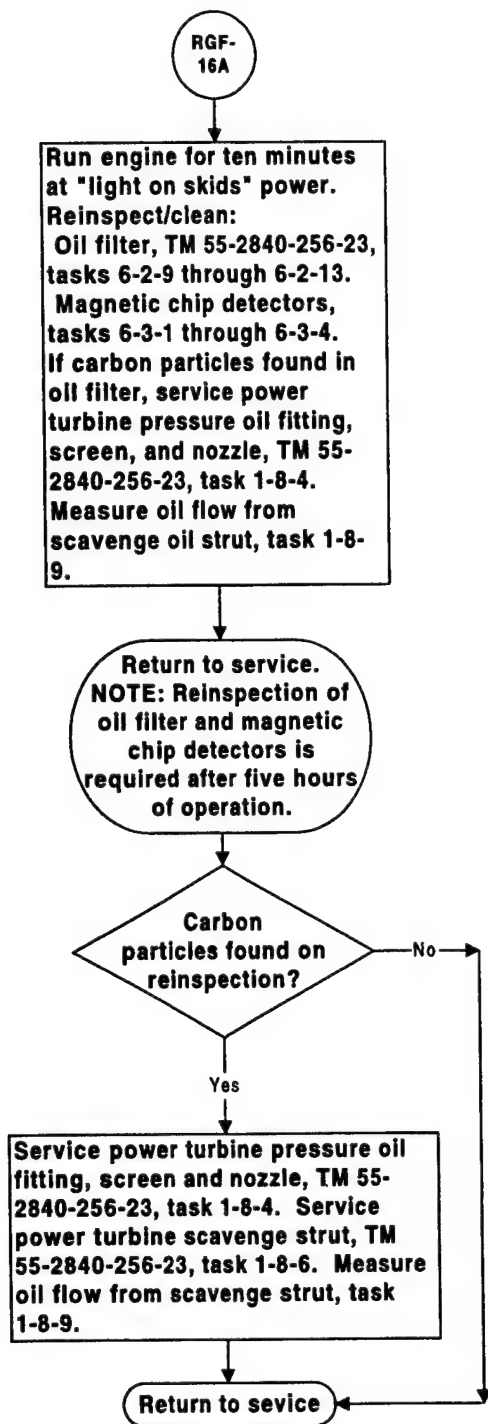
**THIS MAY BE CAUSED BY:** Oil level. Pressure measurement system. Oil pressure regulator. Degraded oil pump. Oil transfer tubes. Aircraft oil system flow restriction. Oil foaming.



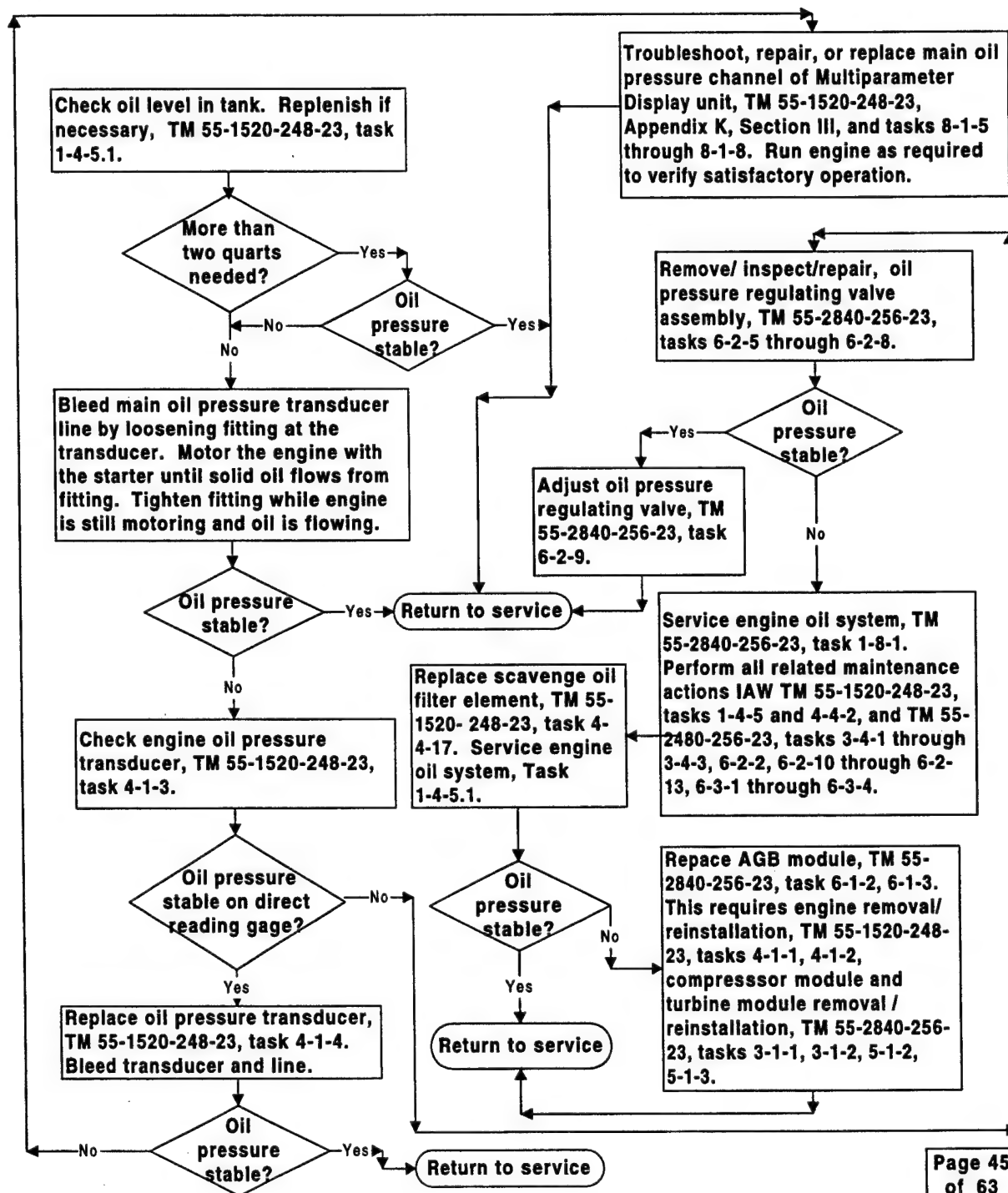
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THIS MAY BE CAUSED BY: Oil temperature measurement system. Aircraft oil cooler, cooler bypass, or thermostat. Cooling fan damaged or obstructed.





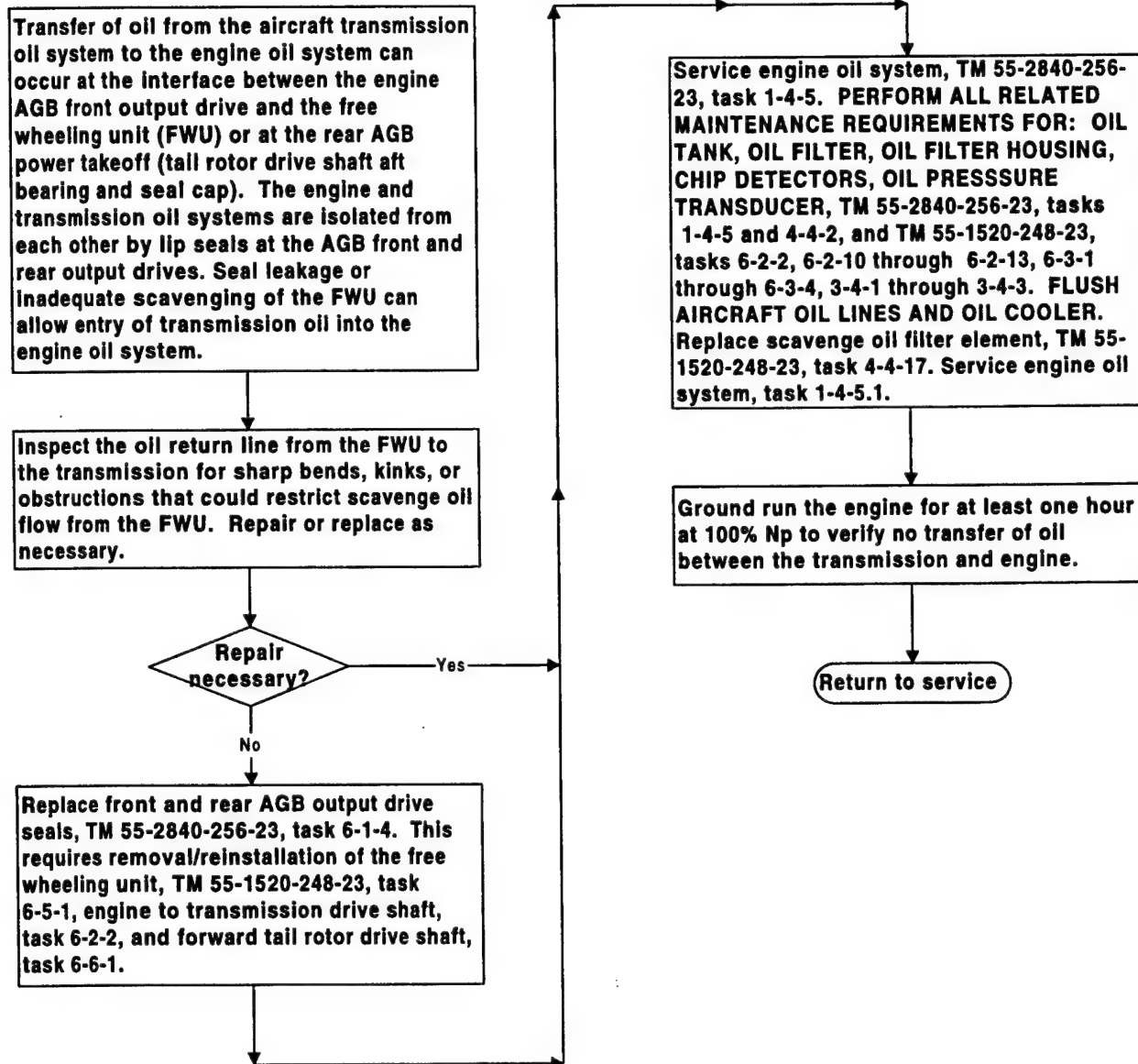
THIS MAY BE CAUSED BY: Oil level. Pressure measurement system. Oil pressure regulator. Air in pressure sensing lines. Oil foaming. Aircraft oil system. Flow restriction. Oil pump.



**RGF-17 ENGINE OIL TANK FILLS DURING FLIGHT AS TRANSMISSION OIL LEVEL DECREASES.**

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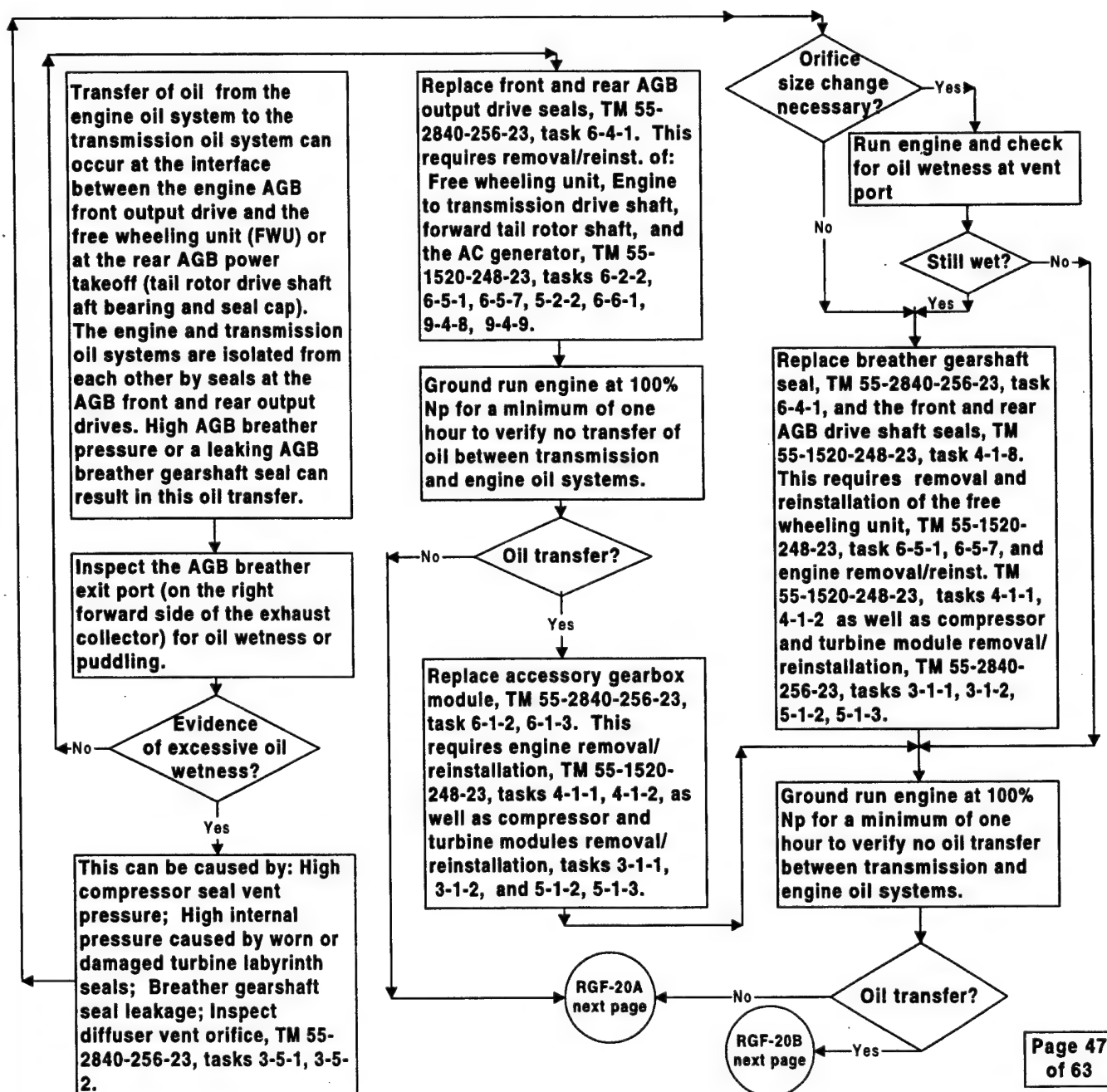
**THIS CAN ONLY RESULT FROM TRANSFER OF OIL FROM THE AIRCRAFT TRANSMISSION OIL SYSTEM TO THE ENGINE OIL SYSTEM THROUGH LEAKING SEALS AT THE AGB FRONT OR REAR (MAIN ROTOR AND TAIL ROTOR DRIVE), POWER OUTPUT LOCATIONS.**



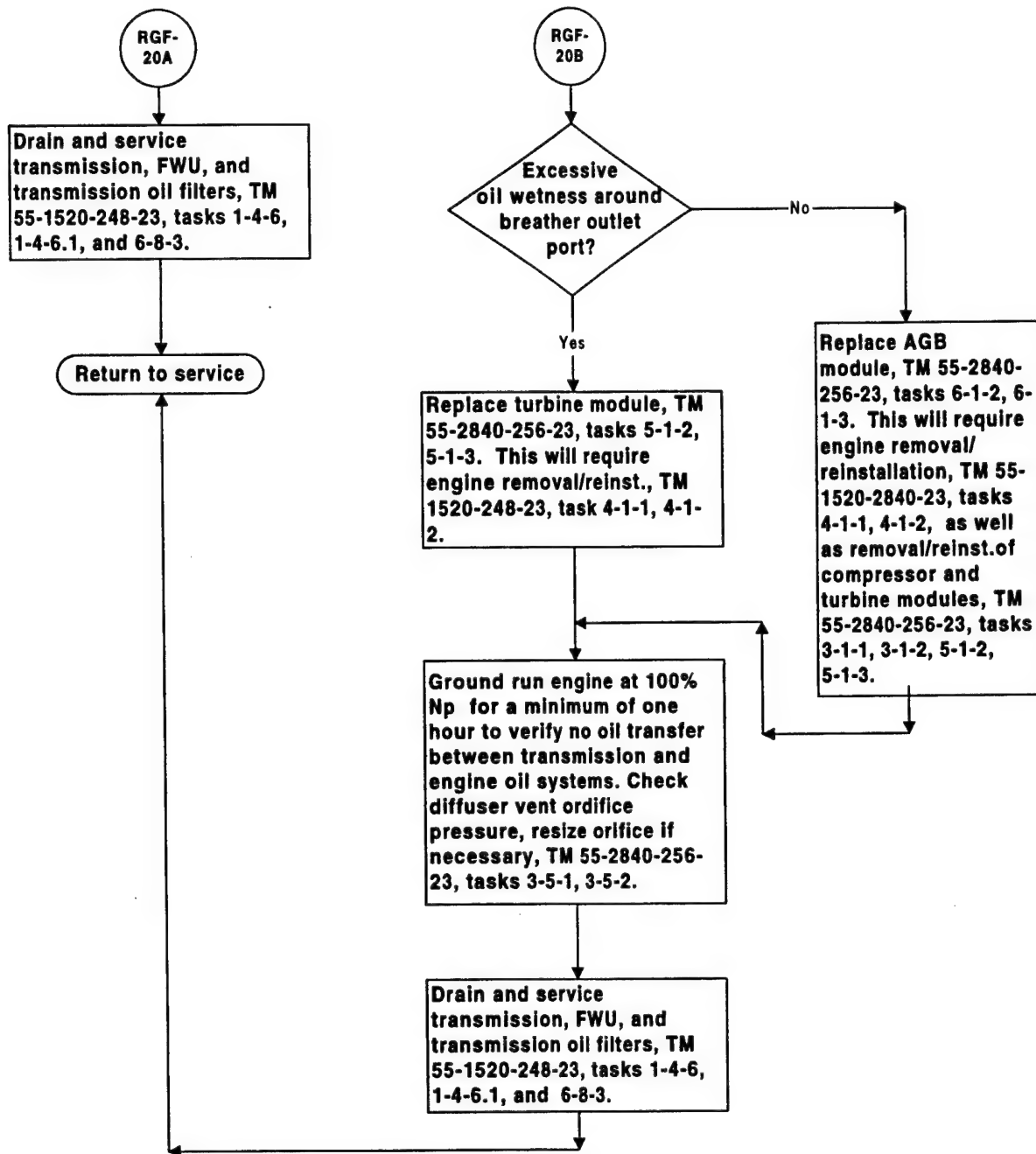
# RGF-18 TRANSMISSION OIL LEVEL INCREASES DURING FLIGHT AS ENGINE OIL TANK EMPTIES.

Page 1 of 2

THIS CAN ONLY RESULT FROM TRANSFER OF OIL FROM THE ENGINE OIL SYSTEM TO TRANSMISSION OIL SYSTEM THROUGH OIL BEING FORCED, OR LEAKING, THROUGH THE SEALS AT THE AGB FRONT OR REAR (MAIN ROTOR AND TAIL ROTOR DRIVE) POWER OUTPUT LOCATIONS.

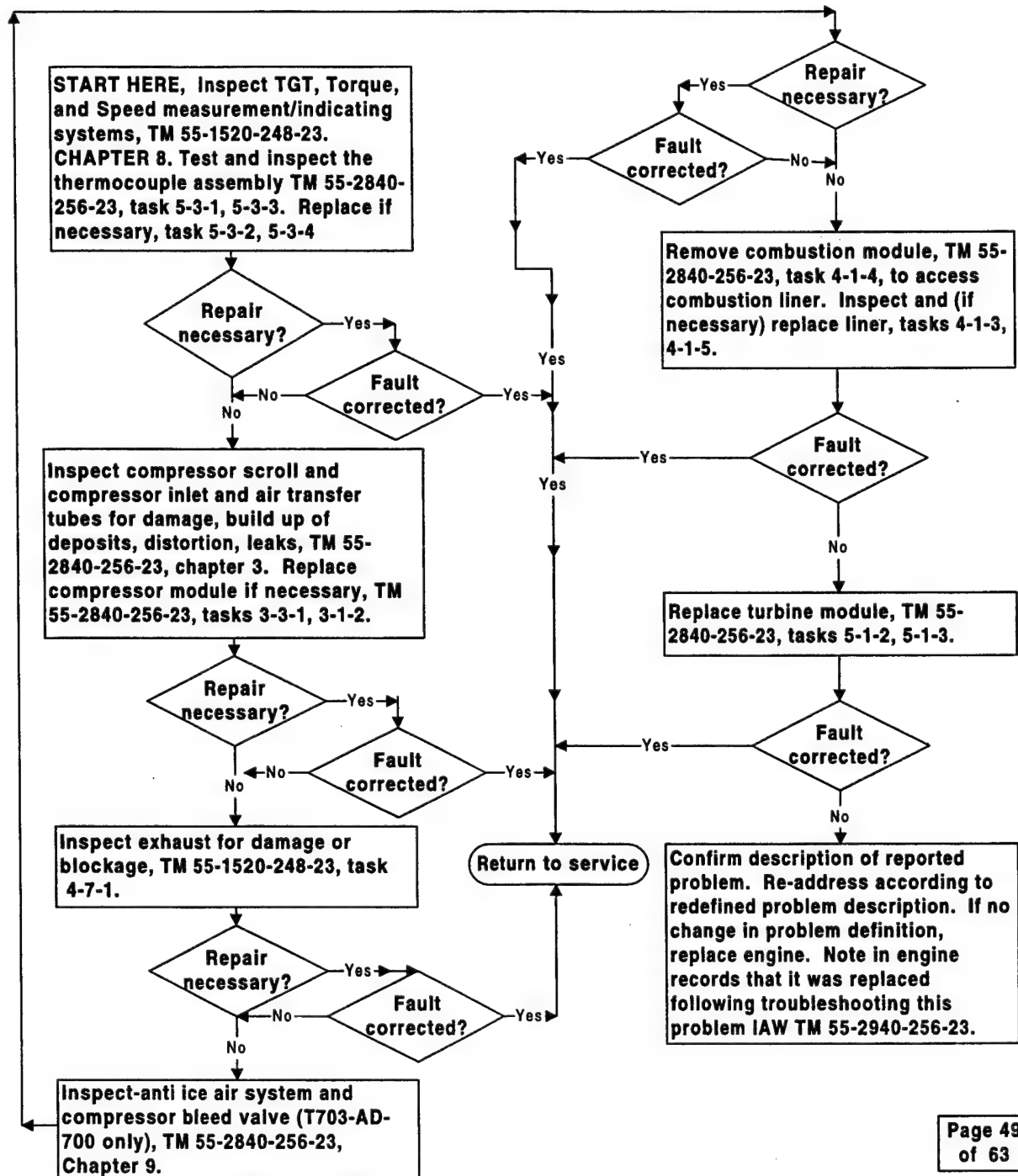


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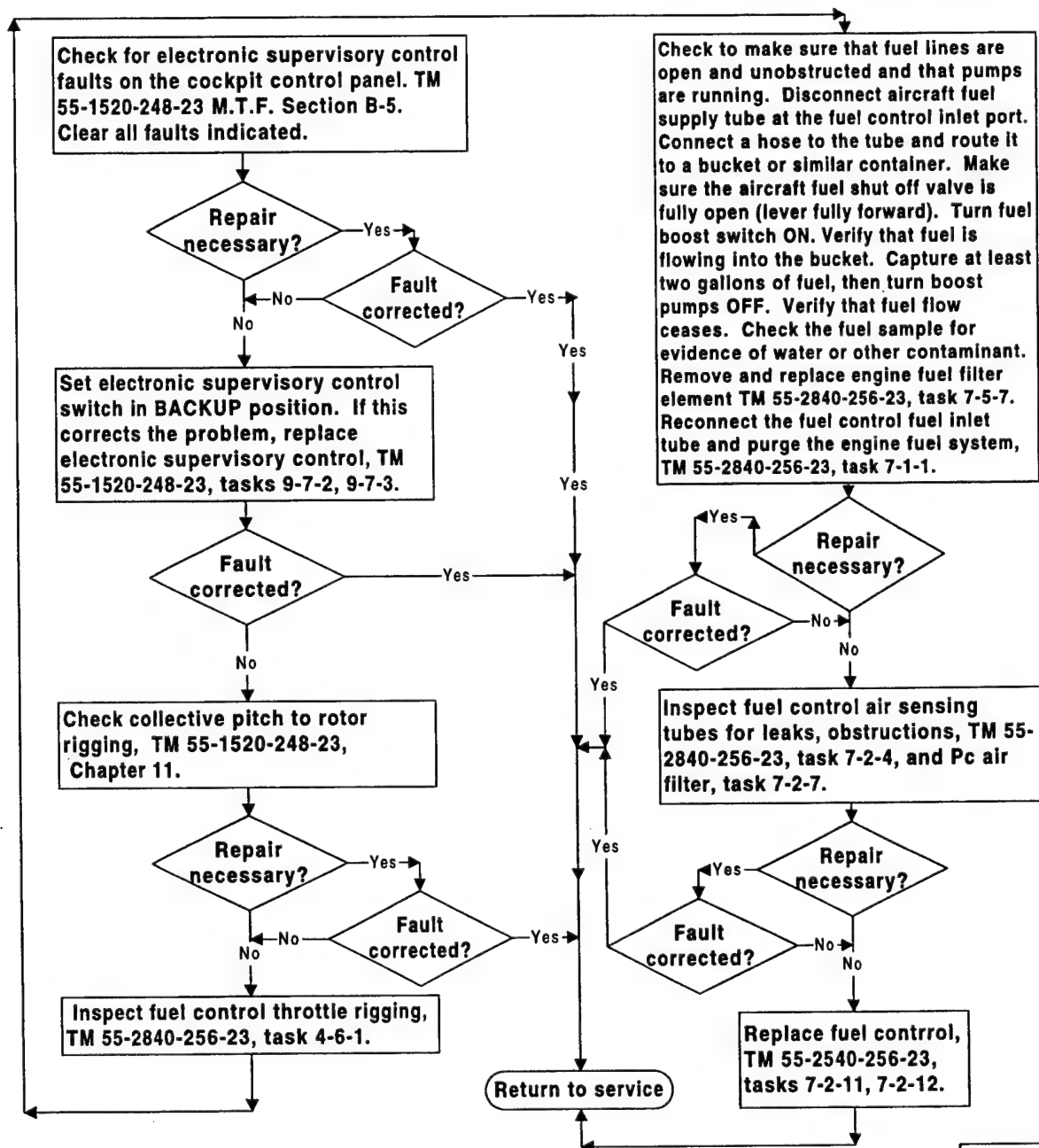




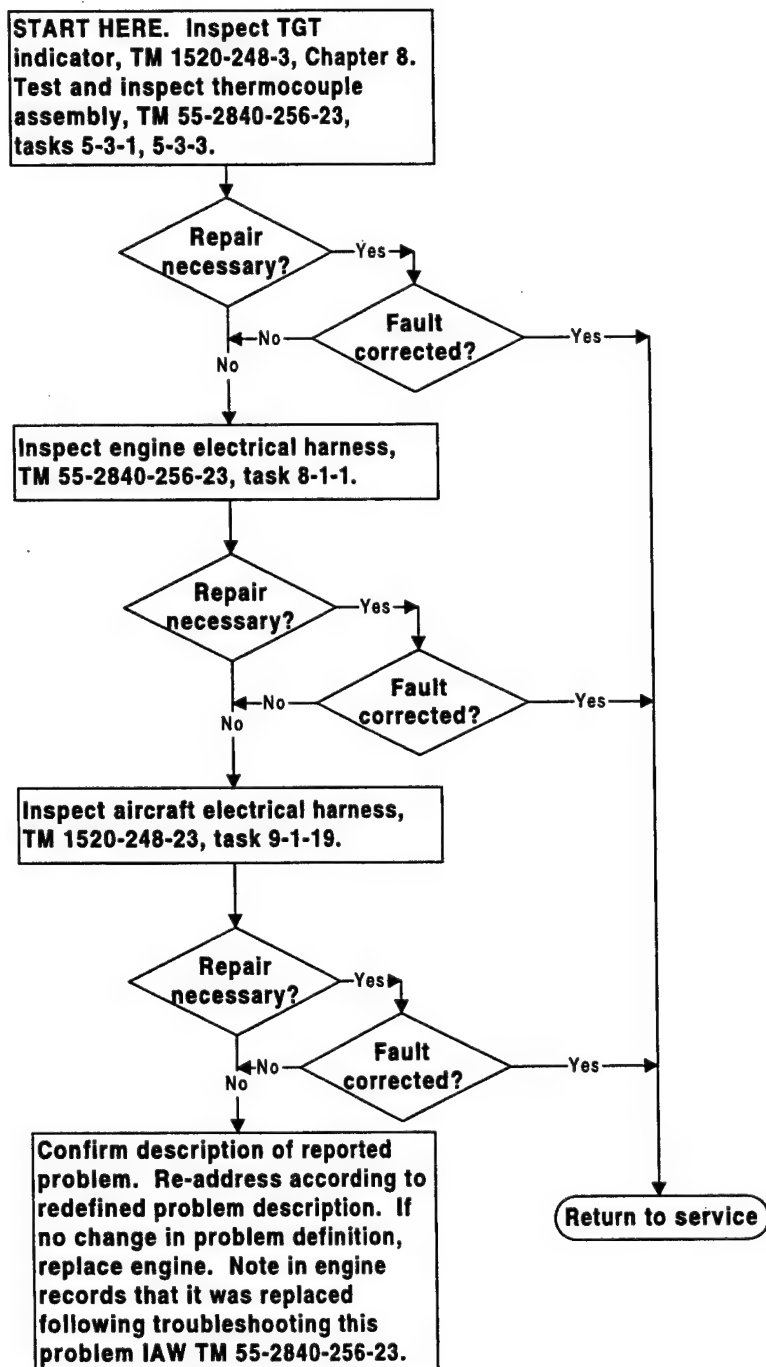
**THIS MAY BE CAUSED BY:** Ng, Torque, or Np measuring systems. Dirty or degraded/damaged compressor. Degraded turbine. Blocked or distorted compressor inlet. Blocked exhaust. Anti-icing system on or leaking. External air leaks. Accessory bleed open. Degraded combustor. No. 6 and 7 area labyrinth seals having excessive clearance.



**THIS CAN BE CAUSED BY:** Fuel control throttle lever not at the maximum stop. Collective pitch to rotor rigging. Restriction in fuel supply. Low inlet pressure to the fuel pump. Dirty fuel filter. Pneumatic leak in fuel control air sensing tubes. Clogged Pc air filter or air sensing tube. Improperly shimmed or blocked fuel nozzle. Fuel control malfunction. Electronic supervisory control.



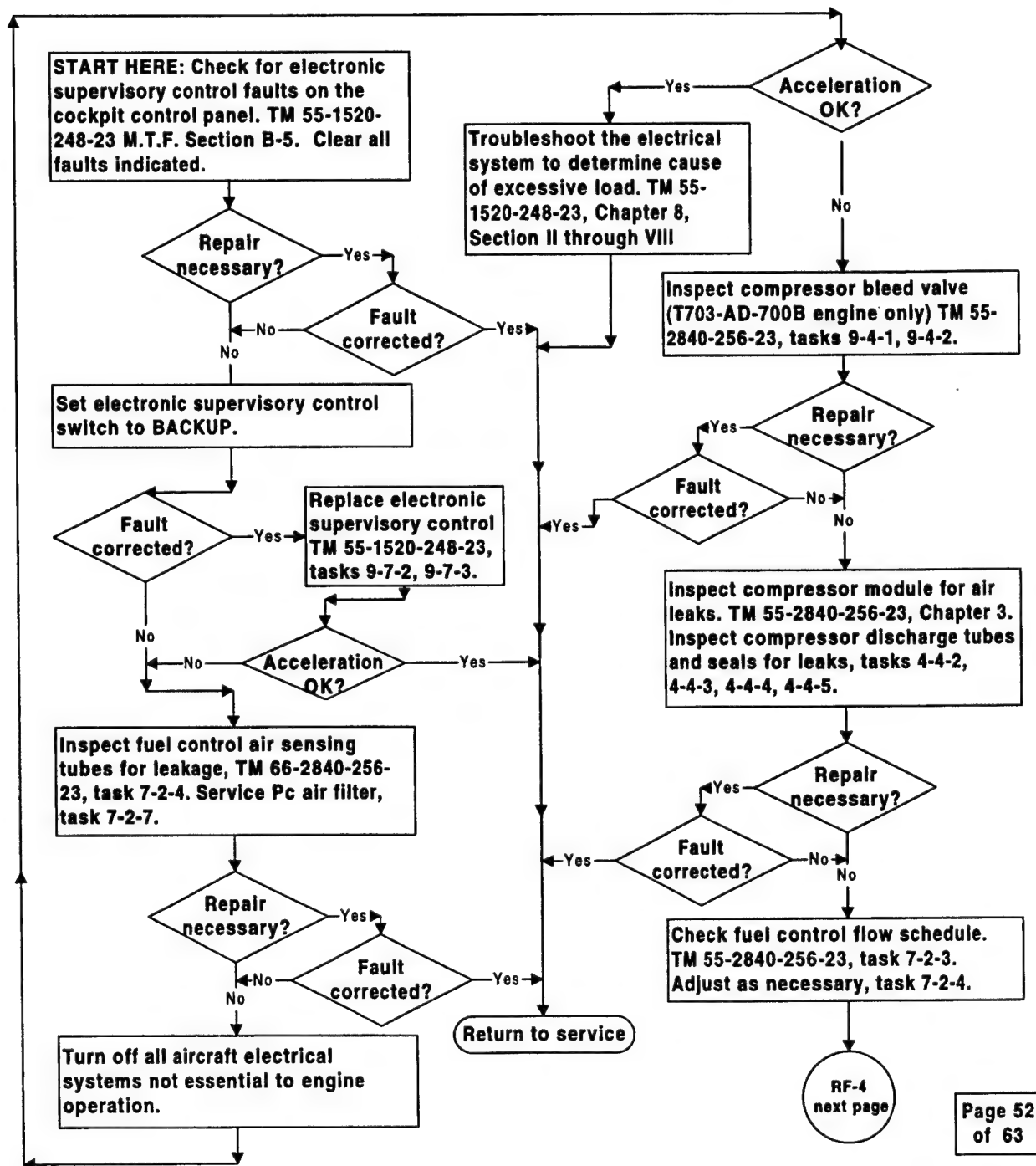
THIS CAN BE CAUSED BY: TGT indicator, thermocouple, or harness. Engine electrical harness. Aircraft electrical harness. NOTE: IF THE ENGINE IS PRODUCING NORMAL POWER, THE FUEL CONTROL SYSTEM CANNOT CAUSE A TGT ERROR.

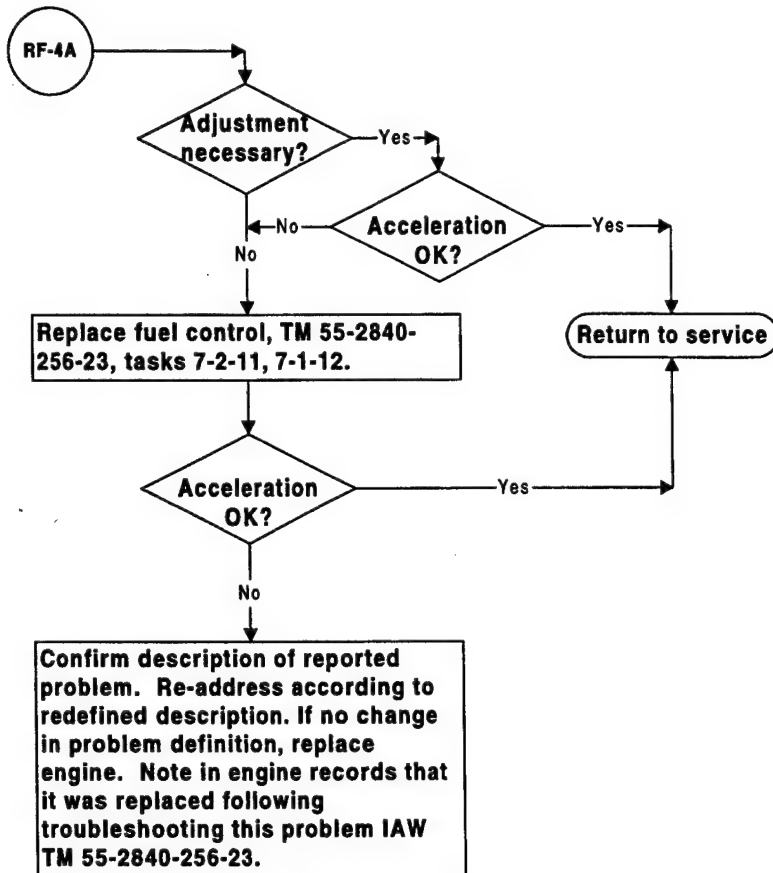


# RF-4 SLOW TO ACCELERATE TO POWER - ROTOR DROOP WITH COLLECTIVE PITCH INCREASE.

Page 1 of 2

**THIS CAN BE CAUSED BY:** Pneumatic leak in fuel control air sensing tubes. Excessive generator load. Bleed valve stuck open (T703-AD 700B engine only). Excessive compressor air leakage. Fuel control. Electronic supervisory control.

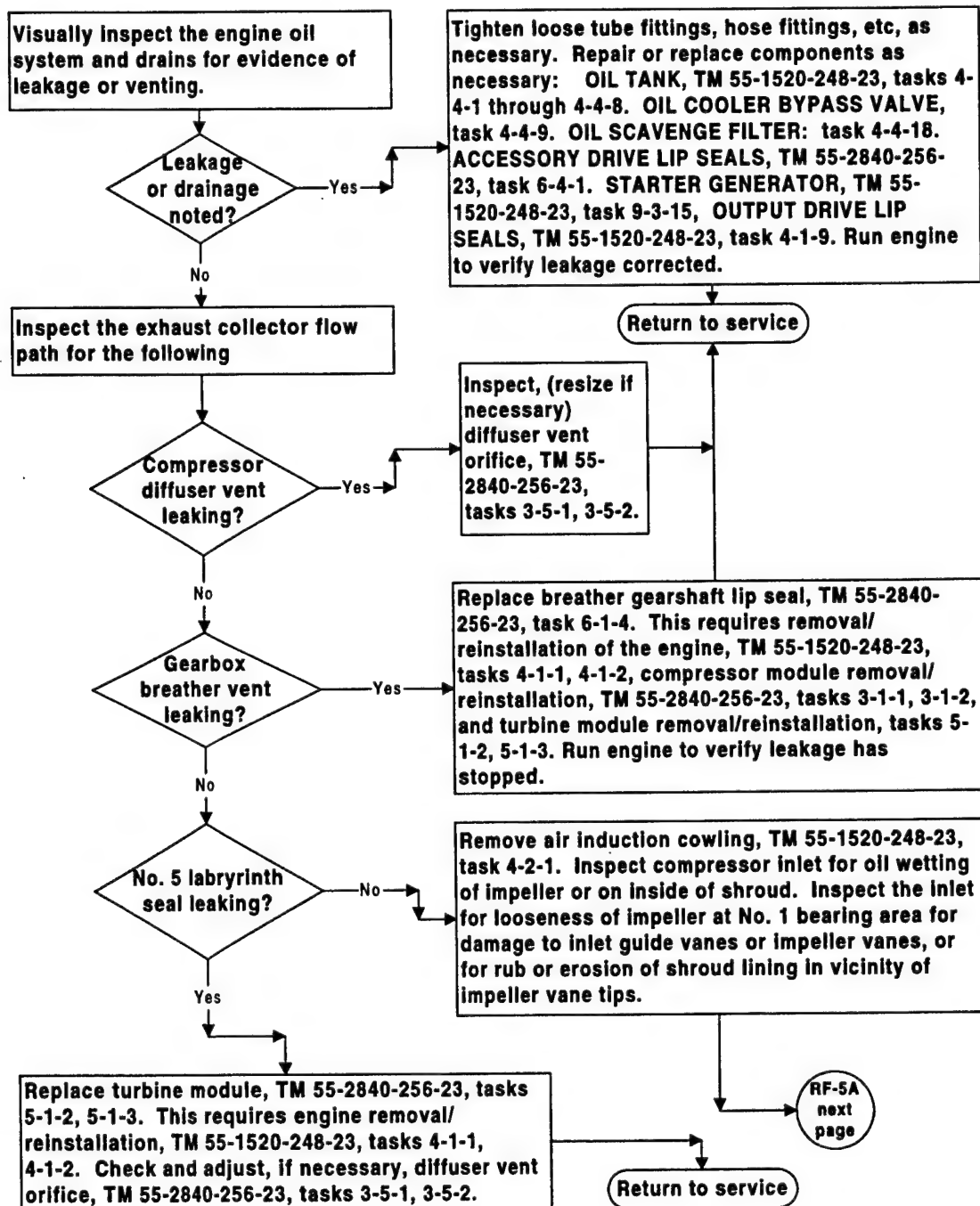




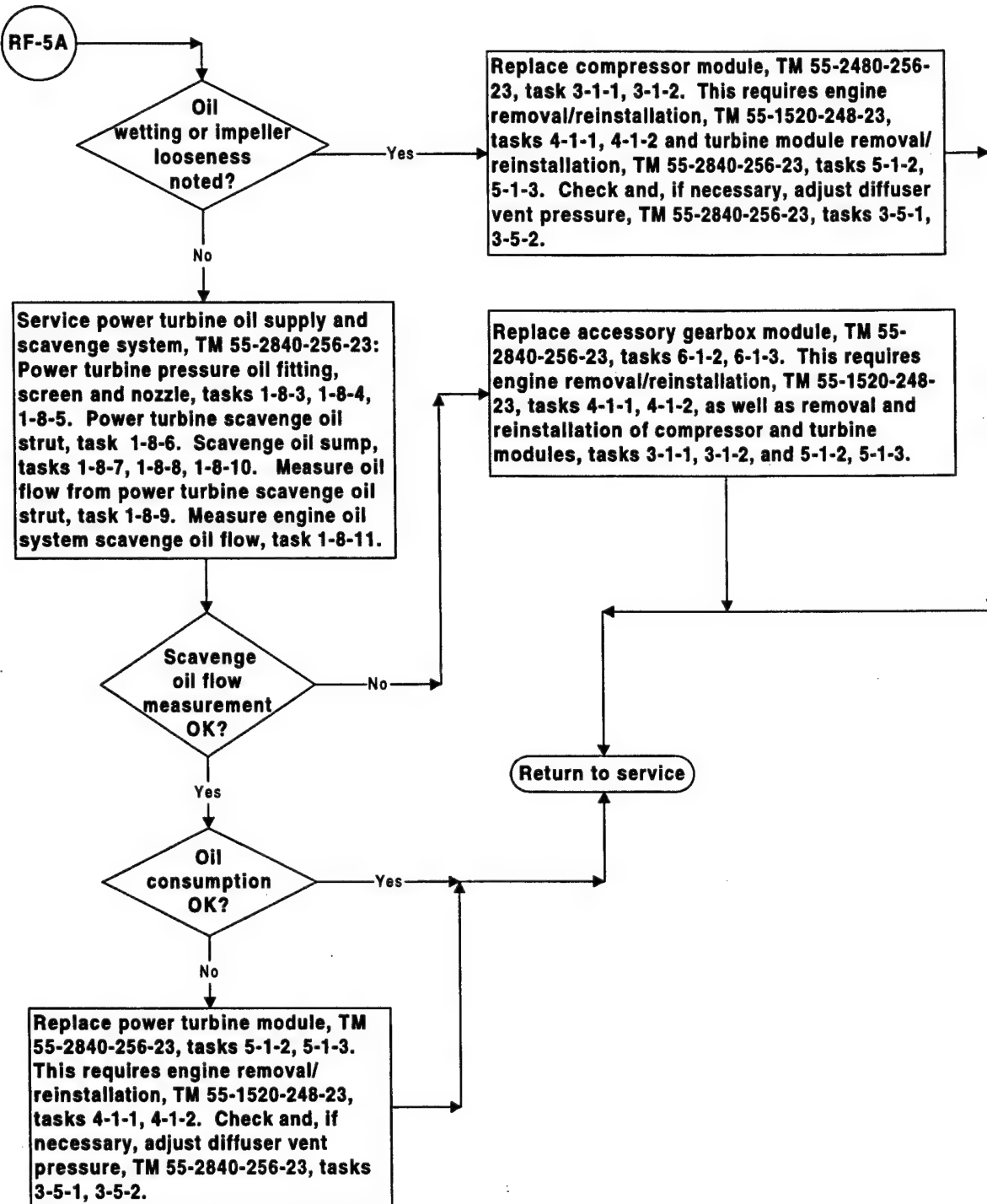
# RF-5 OIL CONSUMPTION EXCEEDS ONE QUART PER FIVE HOURS OF ENGINE OPERATION.

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**THIS MAY BE CAUSED BY:** External leak, engine or aircraft. AGB lip seal leak. No. 1 seal leak. Turbine sump scavenge strut blockage or inadequate scavenging. High AGB case pressure. No. 5 labyrinth seal leak. Dirty scavenge filter.



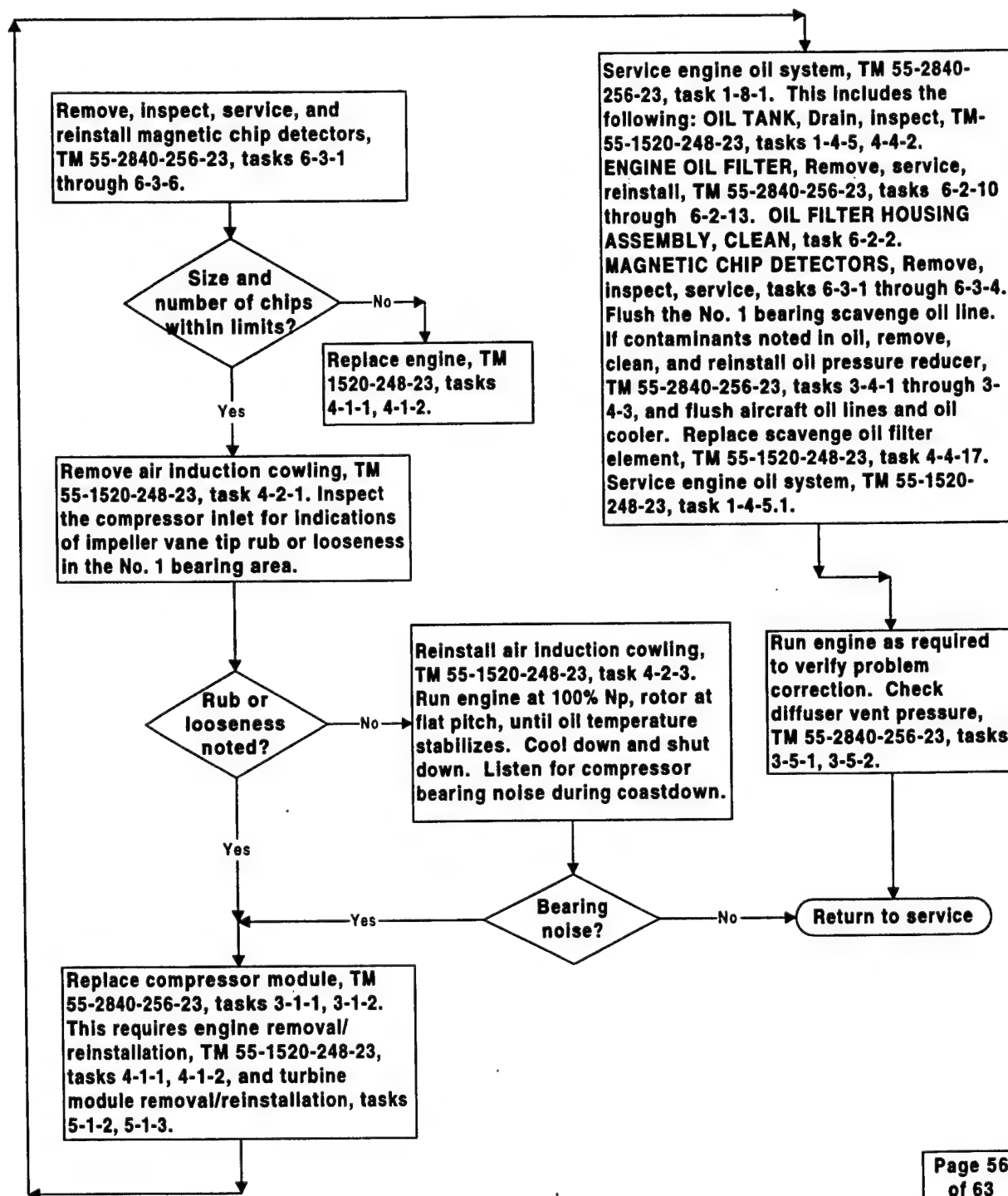
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**OFF-1 BEARING NOISE AT COMPRESSOR WHICH MAY BE ACCOMPANIED BY LOOSENESS OF THE IMPELLER.**

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**THIS IS AN INDICATION OF A BEARING FAILURE.**

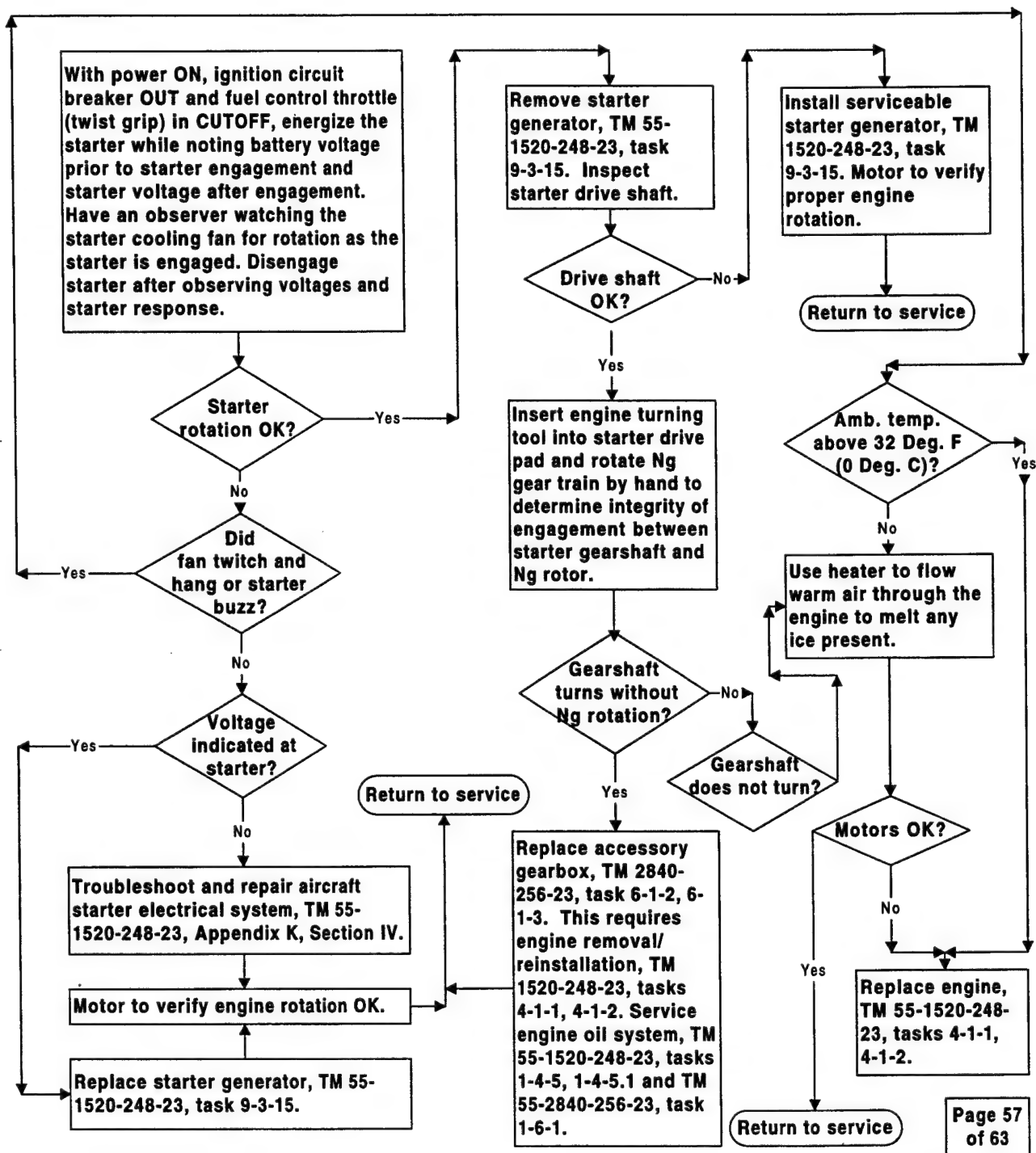




# OFF-2 ENGINE WILL NOT CRANK (STARTER UNABLE TO ROTATE ENGINE).

Page 1 of 1

**THIS MAY BE CAUSED BY:** Insufficient voltage to the starter. Electrically failed or defective starter-generator. Binding of Compressor, Turbine, or Gearbox.



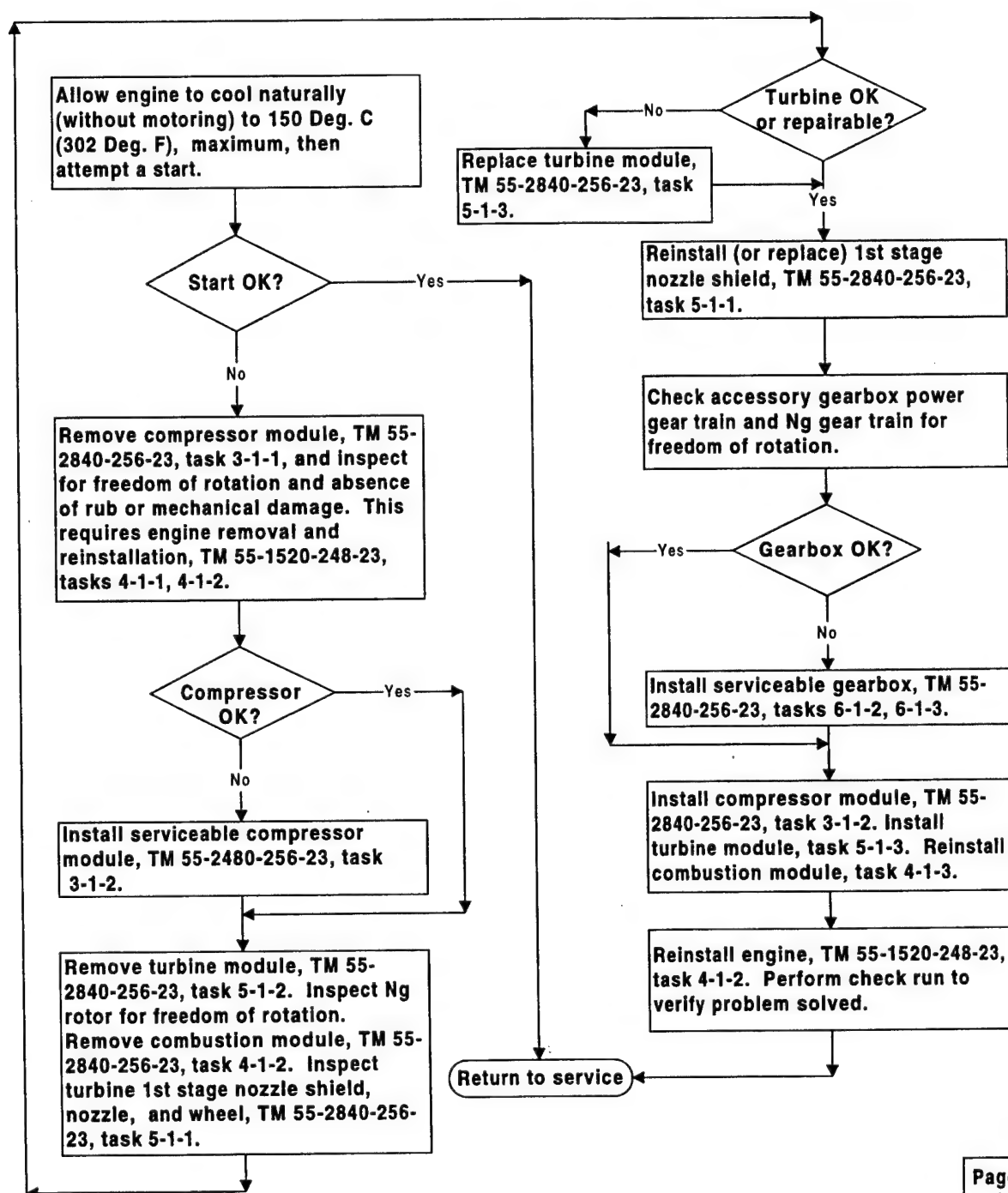
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**OFF-3 STARTER WILL NOT ROTATE ENGINE IMMEDIATELY AFTER SHUT DOWN.**

Page 1 of 1

Rub or binding of rotating components due to differential rate of cooling, or insufficient clearance.



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of 63

**OFF-4 STATIC OIL LEAKAGE FROM POWER AND ACCESSORY GEARBOX  
BREATHER.**

**Page 1 of 1**

**THIS IS AN INDICATION THAT THE OIL FILTER CHECK VALVE IS LEAKING.**

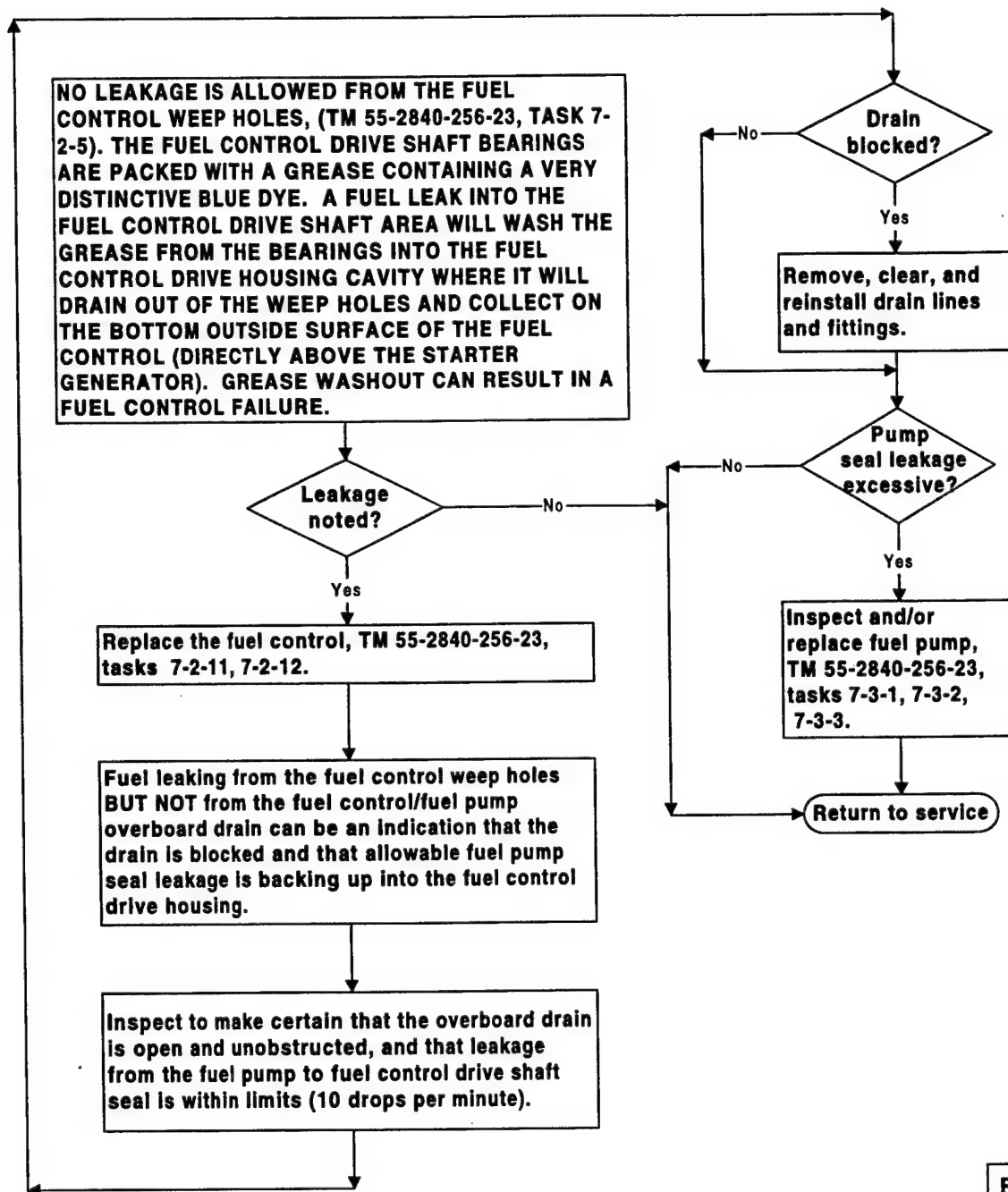
**Remove the oil filter housing and  
check valve assembly. Replace the  
check valve and reinstall the oil filter  
housing and check valve assembly,  
TM 55-2840-256-23, tasks 6-2-3 and  
6-2-4.**

**Return to service**

**Page 59  
of 63**

**OFF-5 FUEL LEAKING FROM THE FUEL CONTROL SEEP HOLES. LEAKAGE MAY BE BLUE IN COLOR AND/OR BLUE STAIN MAY BE FOUND ON THE LOWER EXTERNAL SURFACE OF THE FUEL CONTROL. Page 1 of 1**

**THIS IS AN INDICATION OF A LEAKING FUEL PUMP DRIVE SHAFT SEAL, OR FUEL PUMP DRIVE O-RING LEAK.**

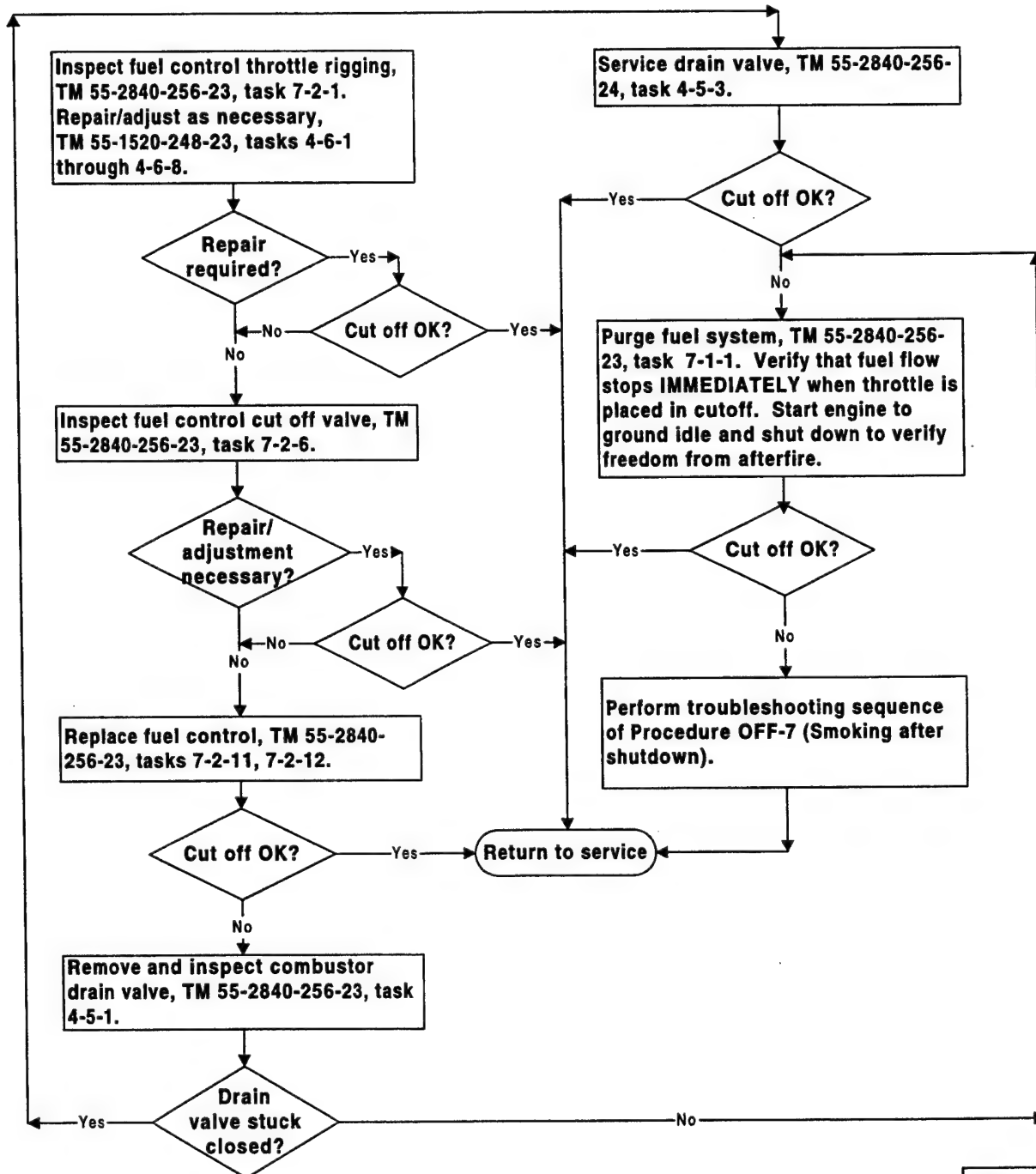


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of 63

**OFF-6 AFTERFIRE. TGT INCREASE AFTER ENGINE SHUTDOWN  
INDICATING RESIDUAL FIRE IN THE COMBUSTOR.**

Page 1 of 1

**THIS CAN BE CAUSED BY: Fuel control cut off valve not fully closed. Oil leak. Sticking burner drain valve. Burner drain valve line obstruction.**

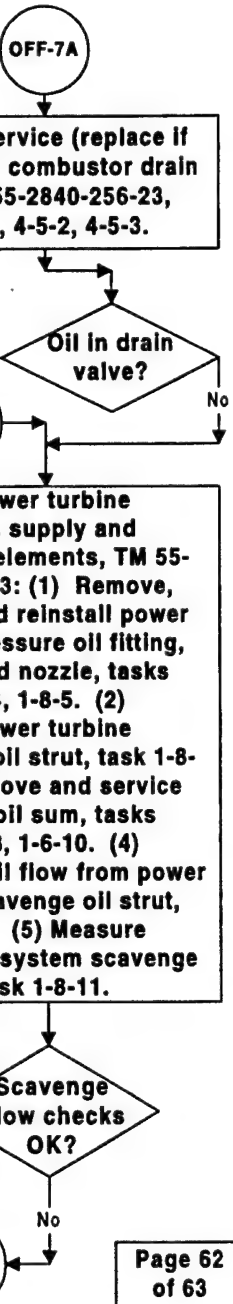


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of 63

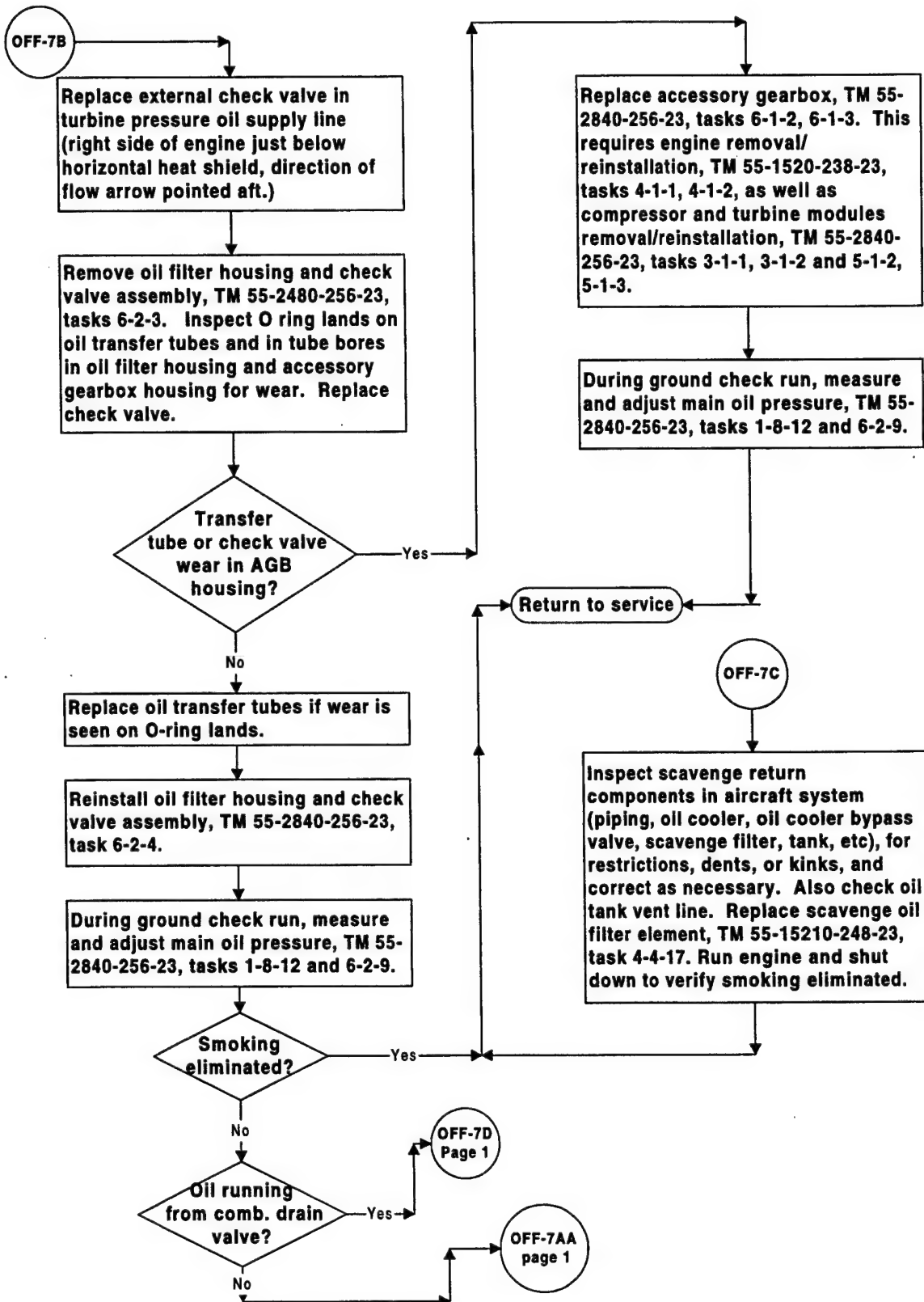
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## Page 1 of 2

**THIS MAY BE CAUSED BY: Exhaust collector drain restricted. Combustor drain restricted. Blocked power turbine scavenge strut. Aircraft system scavenge flow restricted. Scavenge flow from turbine restricted. Defective turbine seals. Leaking oil transfer tubes or check valve. Defective oil pump.**



**Rev. 11 Jul 99**



**Appendix B**  
**Model 250-C30R/3 Basic Engine Fault Isolation and Correction**  
**Visio Charts**

51 Procedures (146 pages)



St-1 intentionally omitted.

## St-2. Compressor Surges During Starts

Page 1 of 3

There are several causes of compressor surge during engine starting, among which are:

- ECU fault
- HMU fault
- Compressor inlet thermal distortion (exhaust gas ingestion)
- Compressor inlet blockage or pressure distortion
- Compressor inducer bleed duct blockage or hose disconnection
- Compressor contamination, damage or erosion
- Turbine blockage or damage

If surges during starting are encountered, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the surge problem still exists.

Were ECU or HMU replaced?

Yes

Was subsequent start OK?

Yes

Return to service

Verify surging was not result of exhaust gas ingestion, by heading aircraft into wind during starting (if it had been positioned with tail into wind when surging occurred). If so, attempt a start.

Had aircraft been positioned tail to wind?

Yes

Did repositioning eliminate surging?

Yes

Return to service

Visually inspect compressor air inlet for blockage, by viewing through inlet plenum observation window.

Compressor inlet blockage noted?

No

St-2  
A  
(Pg 2)

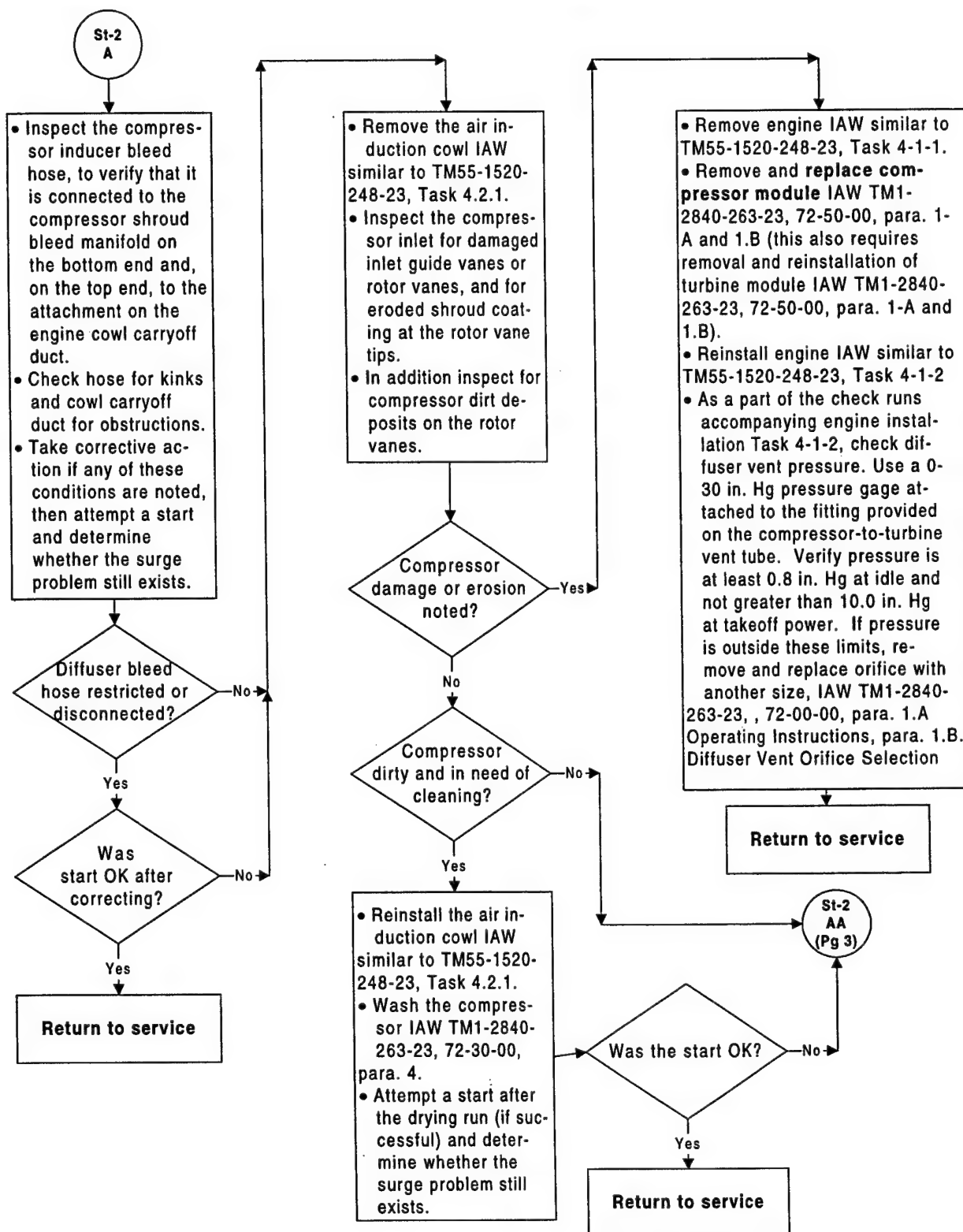
- Remove engine IAW similar to TM55-1520-248-23, Task 4-1-1.
- Remove and replace compressor module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1.B. (This also requires removal and reinstallation of turbine module IAW TM1-2840-263-23, 72-50-00, para. 1-A and 1.B.)
- Identify replaced compressor module as having been subjected to inlet blockage and send to overhaul.
- Determine source of object obstructing compressor inlet and correct condition, which may involve cleaning, inspecting, and repairing air induction cowl IAW similar to TM55-1520-248-23, Task 4-2-2.
- Reinstall engine IAW similar to TM55-1520-248-23, Task 4-1-2.
- As a part of the check runs accompanying engine installation, Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM1-2840-263-23, 72-00-00, para. 1.A Operating Instructions, para. 1.B. Diffuser Vent Orifice Selection

Return to service

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## St-2. Compressor Surges During Starts

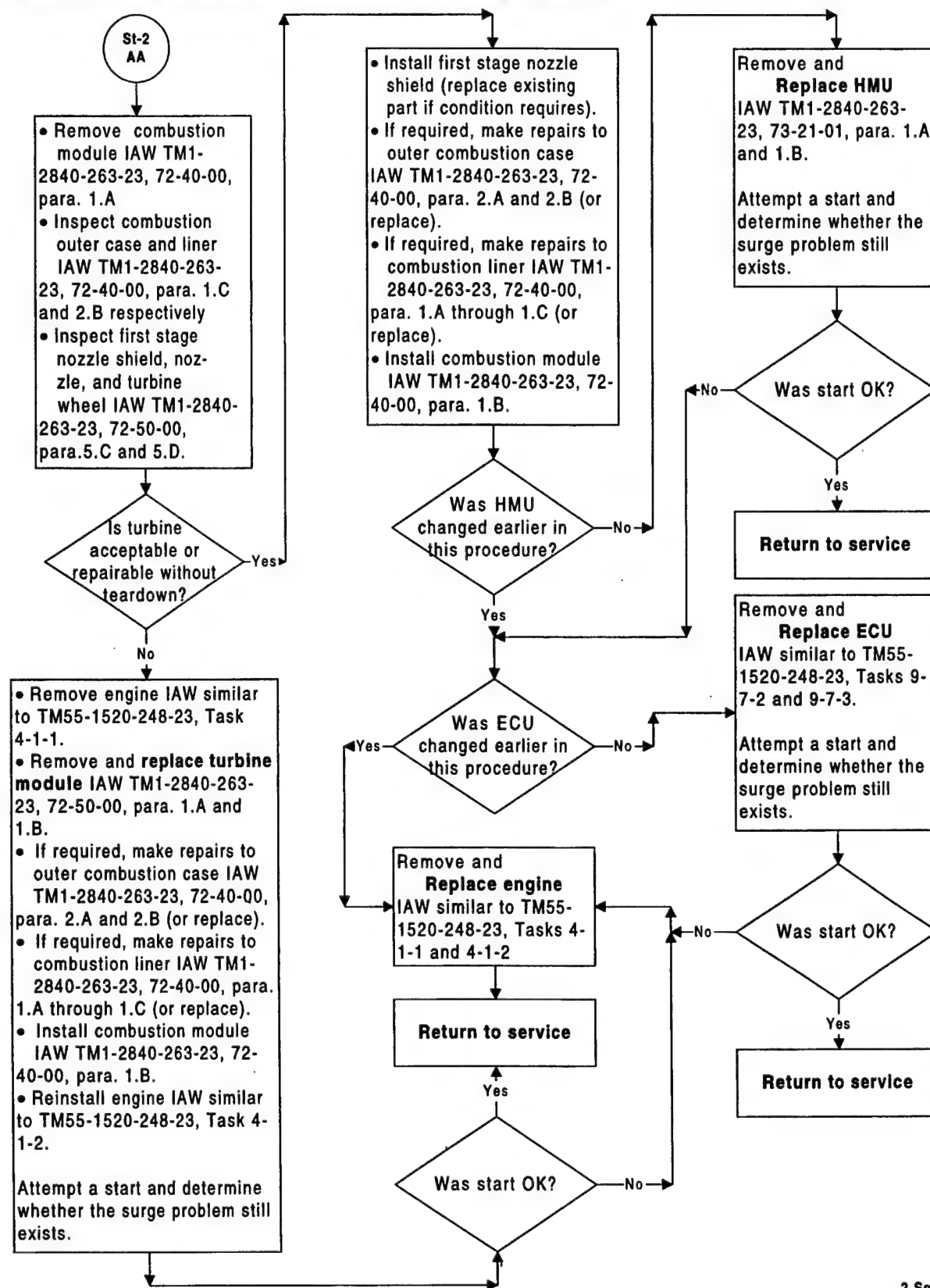
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## St-2. Compressor Surges During Starts

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# **St-3. Flames Out After Lightoff During Start Attempts At High Altitude/Cold Ambient Conditions**

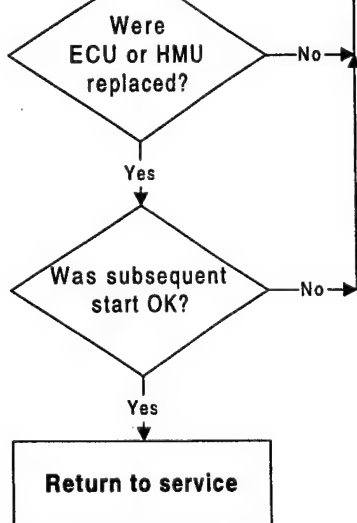
Page 1 of 2

This event, which usually occurs at cold ambient temperatures above 5000 ft. altitude, is normally the result of fuel nozzle carbon deposits, but could also result, among other things, from the following factors:

- HMU
- ECU
- Fuel nozzle immersion depth
- Fuel characteristics
- Combustion module anomaly

If flameouts after lightoff at cold/high altitude conditions are encountered, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the flameout problem still exists.



Remove fuel nozzle, and inspect, service, and inspect flow pattern IAW TM1-2840-263-23, 73-10-03, para. 1.A, 2.A, 2.B, 3.A, and 1.B.

Fuel nozzle flow pattern OK?

Yes

Install fuel nozzle IAW TM1-2840-263-23, 73-10-03, para. 1.B. Select spacers to provide a D dimension as close to the allowable maximum as possible. Attempt a start and determine whether the flameout problem still exists.

Was start OK?

Yes

Return to service

**Replace fuel nozzle**  
Install replacement nozzle IAW TM55-2840-256-23, Task 7-4-5\*. Select spacers to provide a D dimension as close to the allowable maximum as possible. Attempt a start and determine whether the flameout problem still exists.

Was start OK?

Yes

Return to service

Verify type of fuel currently in aircraft tank. For consistent starting at ambient temperatures below +40°F (+4°C), JP-4 (Mil-T-5624) or Jet B (ASTM D-1655) are the recommended fuels.

Current ambient temperature below 40°F?

Yes

St-3 A (Pg 2)

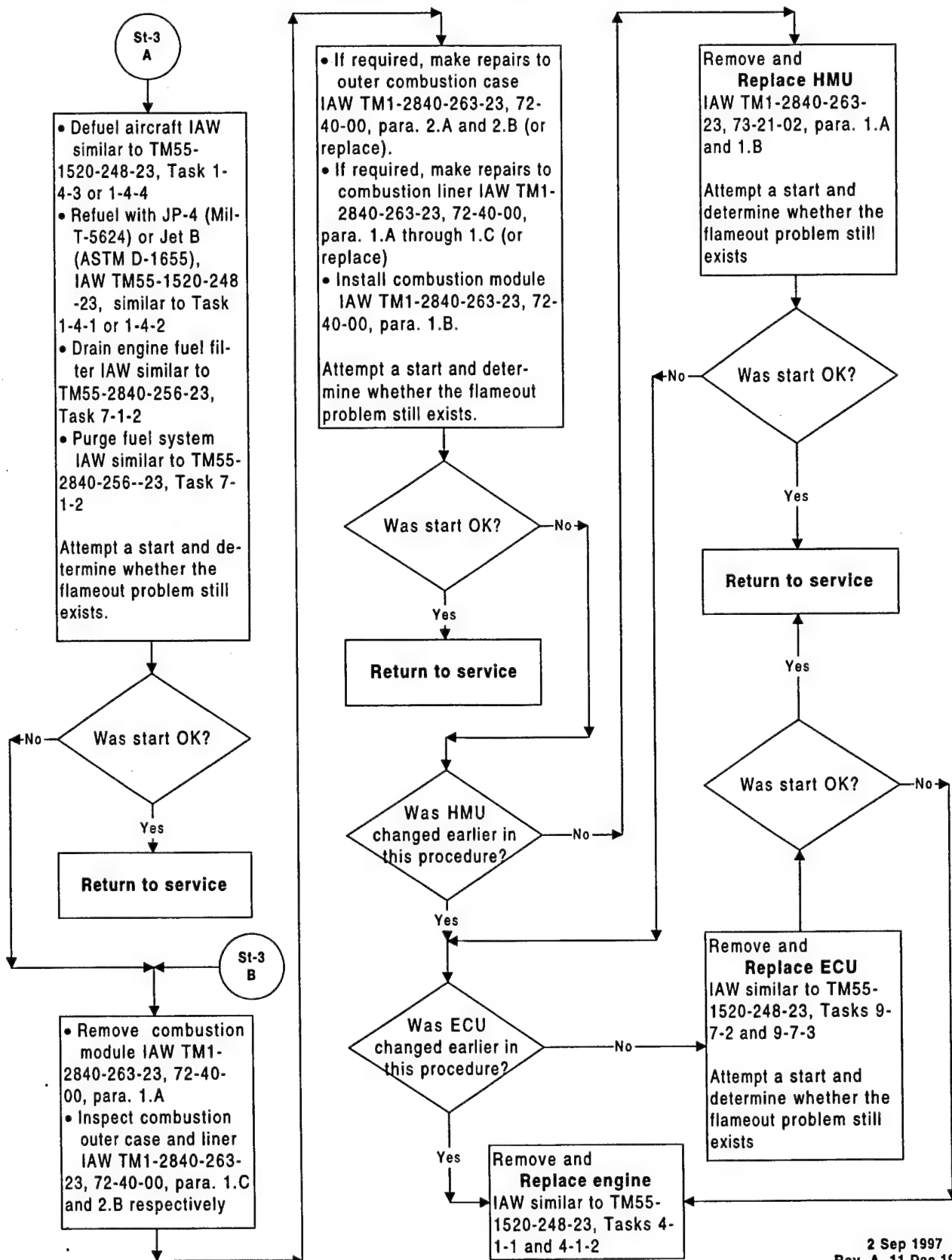
No

St-3 B (Pg 2)

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Rev. A 11 Dec 1997

# **St-3. Flames Out After Lightoff During Start Attempts At High Altitude/Cold Ambient Conditions**

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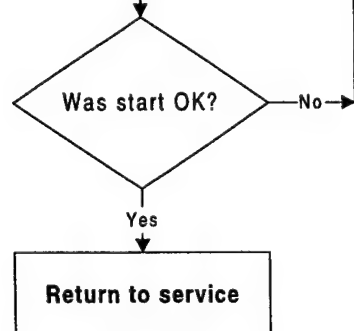
2 Sep 1997 -  
Rev. A 11 Dec 1997

Rich/delayed lightoffs are characterized by a somewhat sharp "WOOF" sound and are frequently accompanied by brief torching from the engine exhaust. They are usually the result of excess raw fuel or oil in the combustion section, or delayed ignition. Most common sources of the problem are:

- ECU
- HMU
- Faulty ignition exciter, lead, or spark igniter
- Faulty burner drain valve
- Faulty check valve in turbine oil supply line
- Faulty main check valve in engine lube system
- Fuel nozzle spray pattern non-uniformity
- Fuel nozzle flow divider

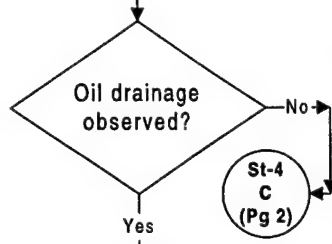
If Rich/Delayed lightoffs are experienced, proceed as follows:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, perform a start and determine whether the lightoff problem still exists.

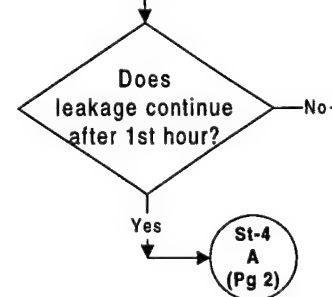


Remove, service, and reinstall burner drain valve, IAW TMI-2840-263-23, 72-40-00, para 3.A. through 3.C

Observe for oil drainage from burner drain port while drain valve removed



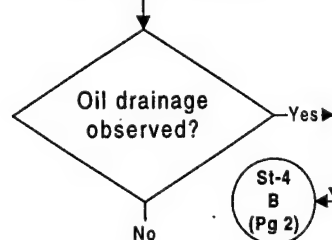
Start engine and run at ground idle until oil temperature stabilizes. Shut down and remove burner drain valve (TMI-2840-263-23, 72-40-00, para 3. A.) just as soon as engine rotors coast down. Place a container under the burner drain boss to collect oil leaking therefrom. Measure and record the amount of leakage each hour for 2 hours.



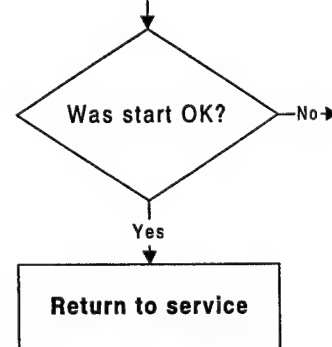
Replace external turbine oil check valve

Reinstall burner drain valve, IAW TMI-2840-263-23, 72-40-00 para 3.B.

Start engine and run at ground idle until oil temperature stabilizes. Shut down and observe for oil drainage through burner drain valve

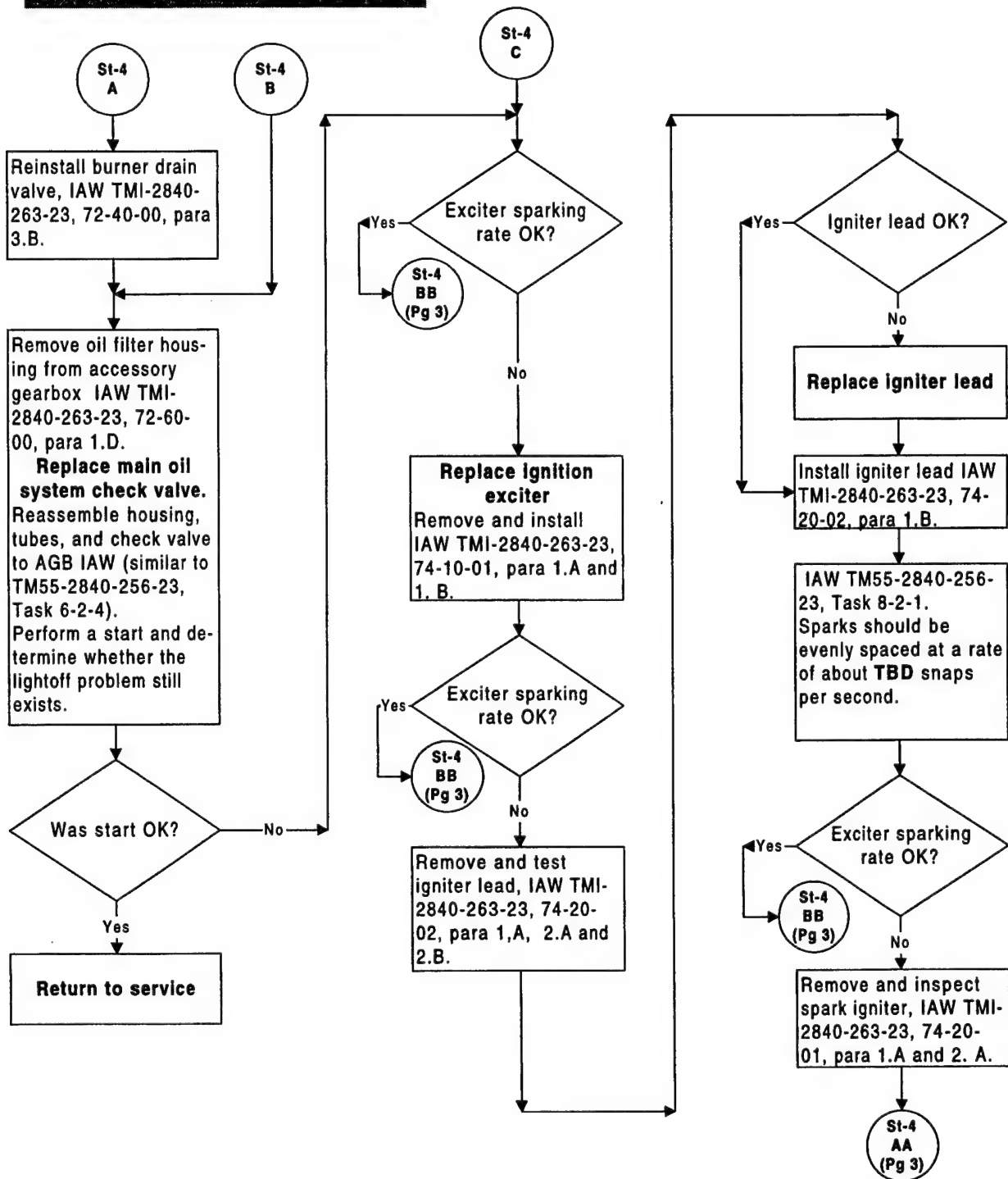


Perform a start and determine whether the lightoff problem still exists.



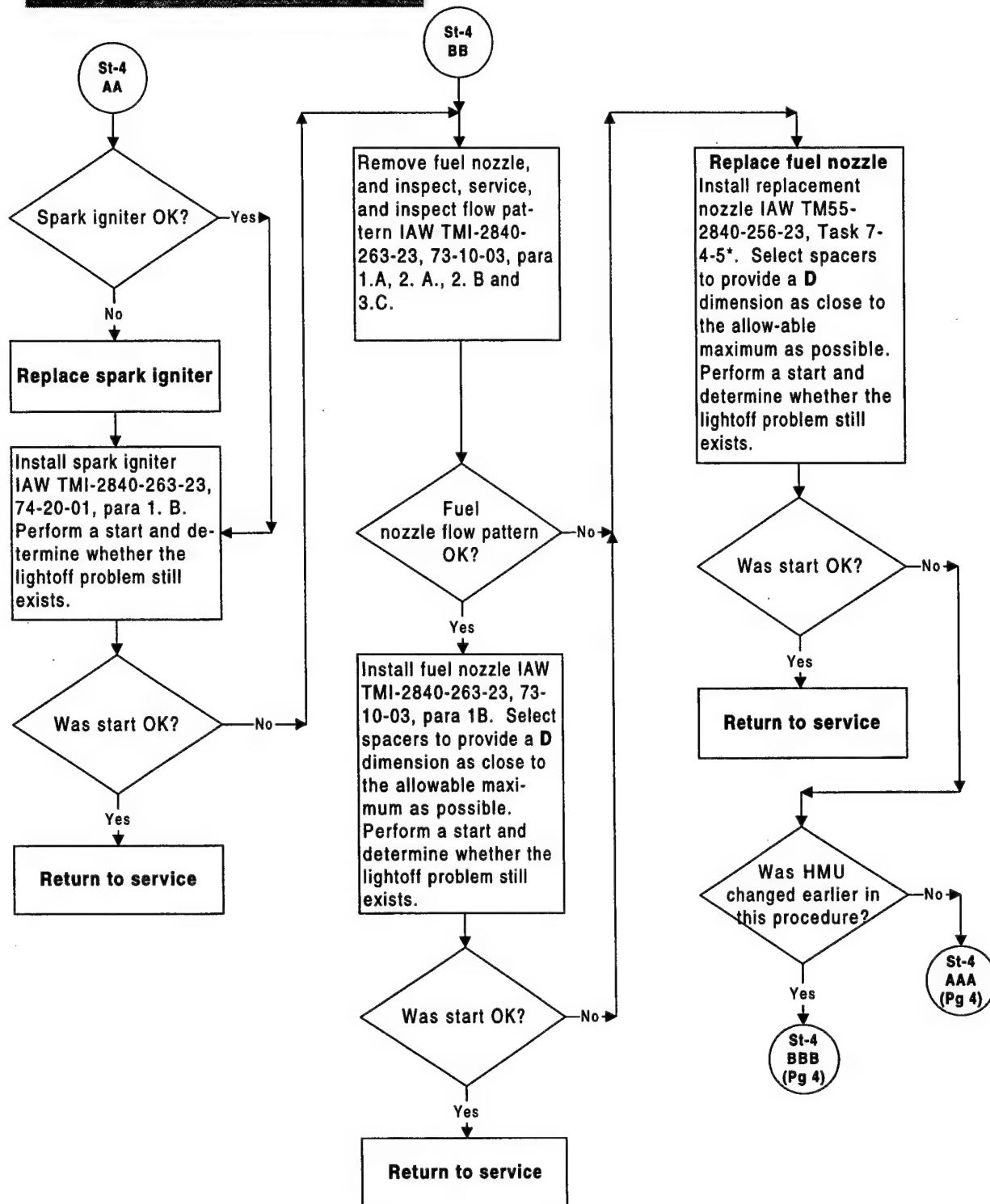
# St-4. Rich/Delayed Light-off

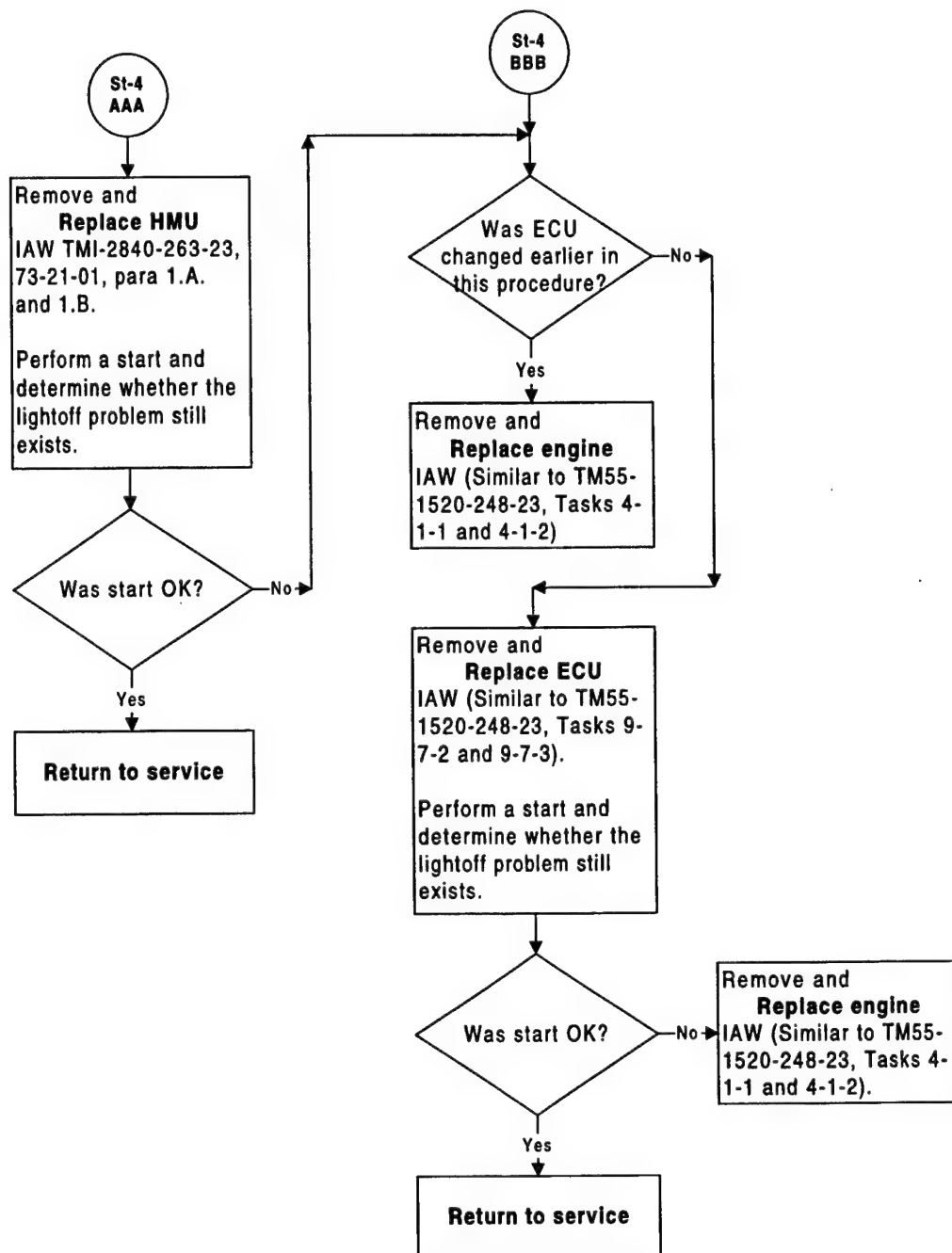
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# **St-5 Motors To Required Speed But Does Not Light Off**

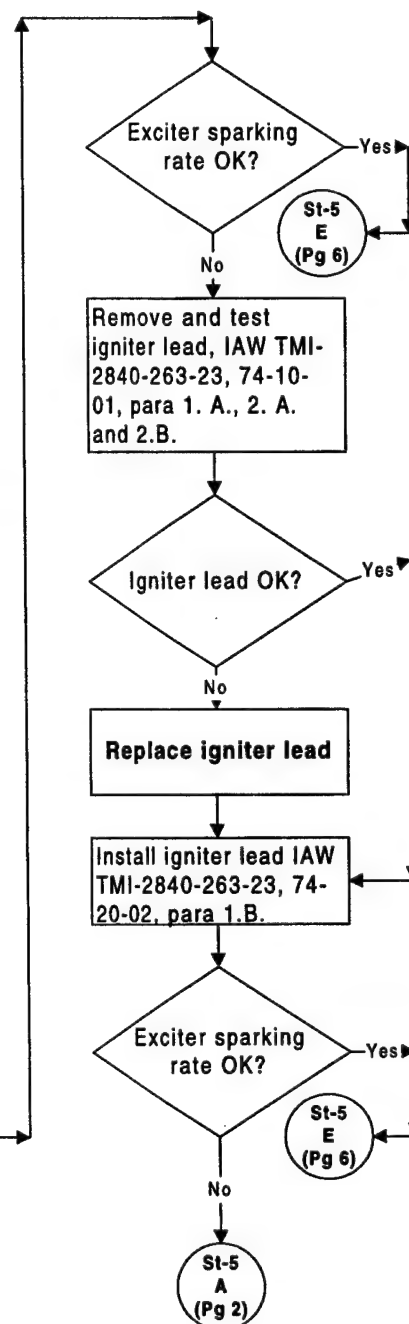
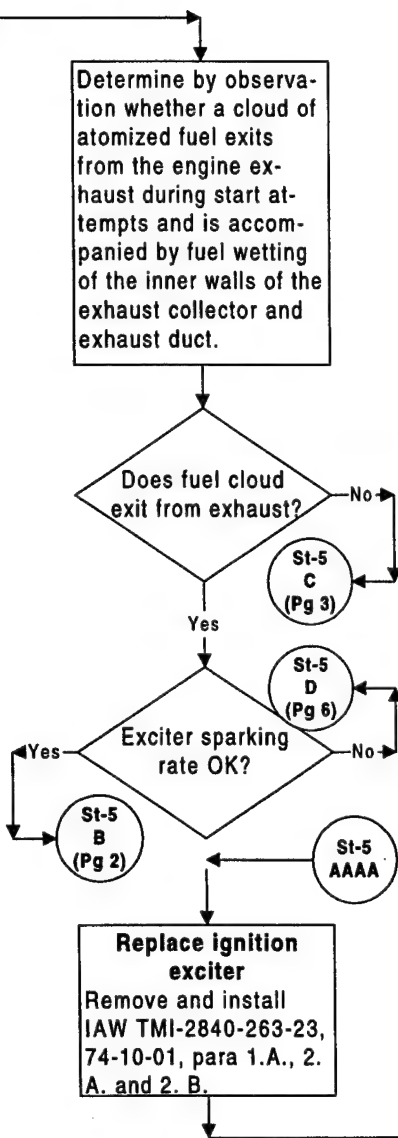
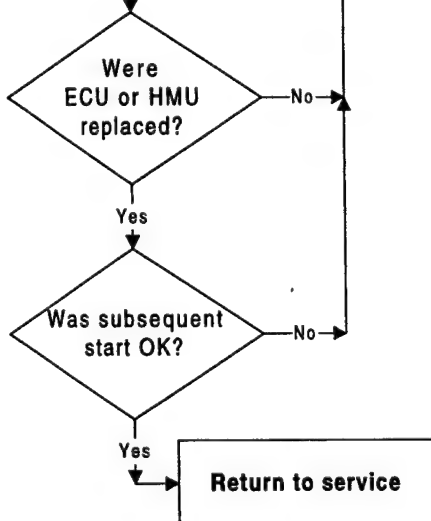
Page 1 of 6

During the normal start sequence, fuel flow is automatically initiated at 12% Ng (10% Ng at engine inlet temperatures below 20°F [-6°C]). Failure to light off at (or above) these speeds may be caused by the following:

- ECU fault
- HMU fault
- Fuel supply blocked or restricted, or no boost
- Throttle linkage misrigged
- Faulty ignition exciter, lead, or spark igniter
- Fuel nozzle spray pattern non-uniform
- Fuel nozzle immersion depth improperly set
- Combustion system anomaly
- Water in fuel

If the engine motors to the required speed but fails to light off, proceed as follows:

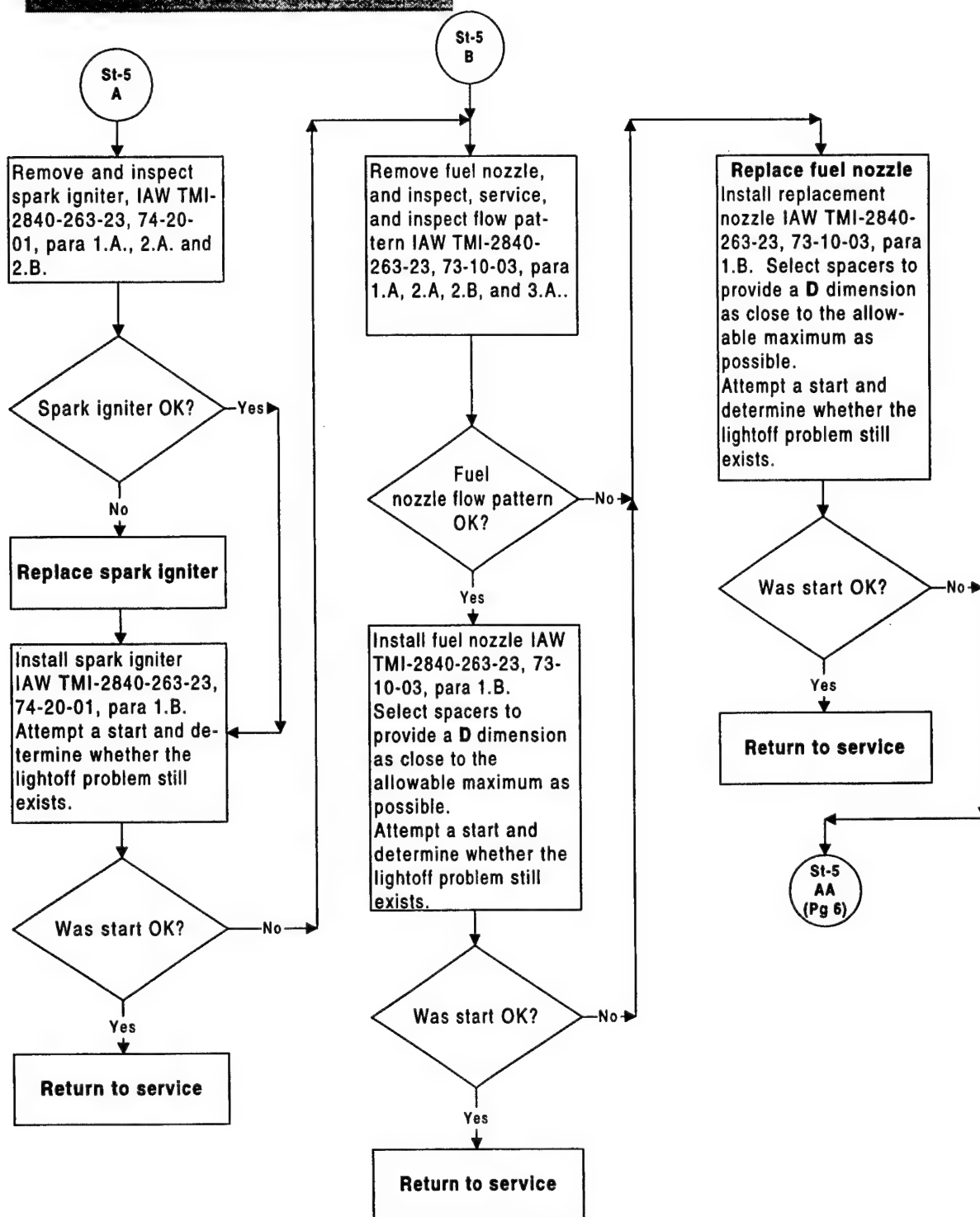
Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether the lightoff problem still exists.



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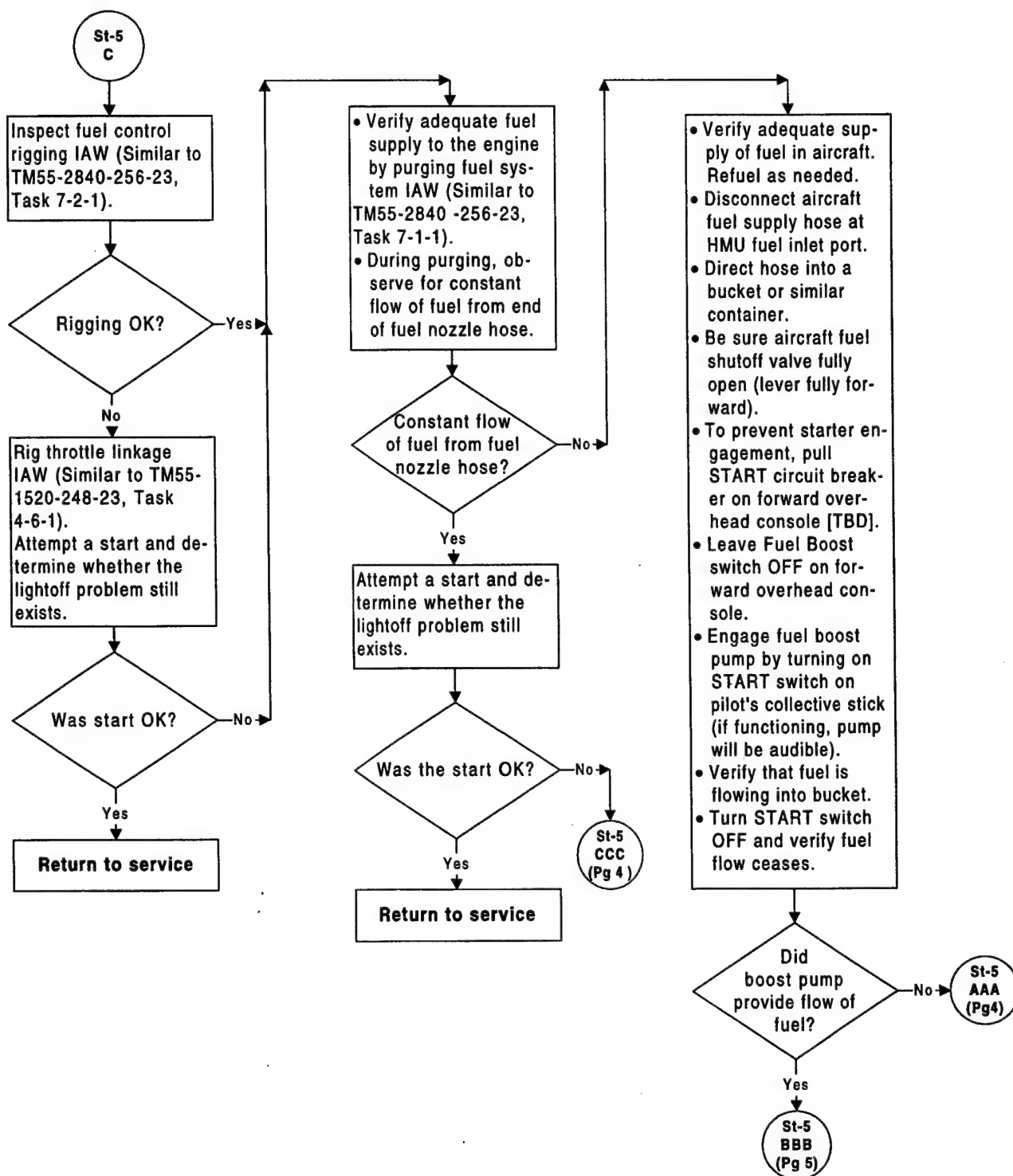
# **St-5 Motors To Required Speed But Does Not Light Off**

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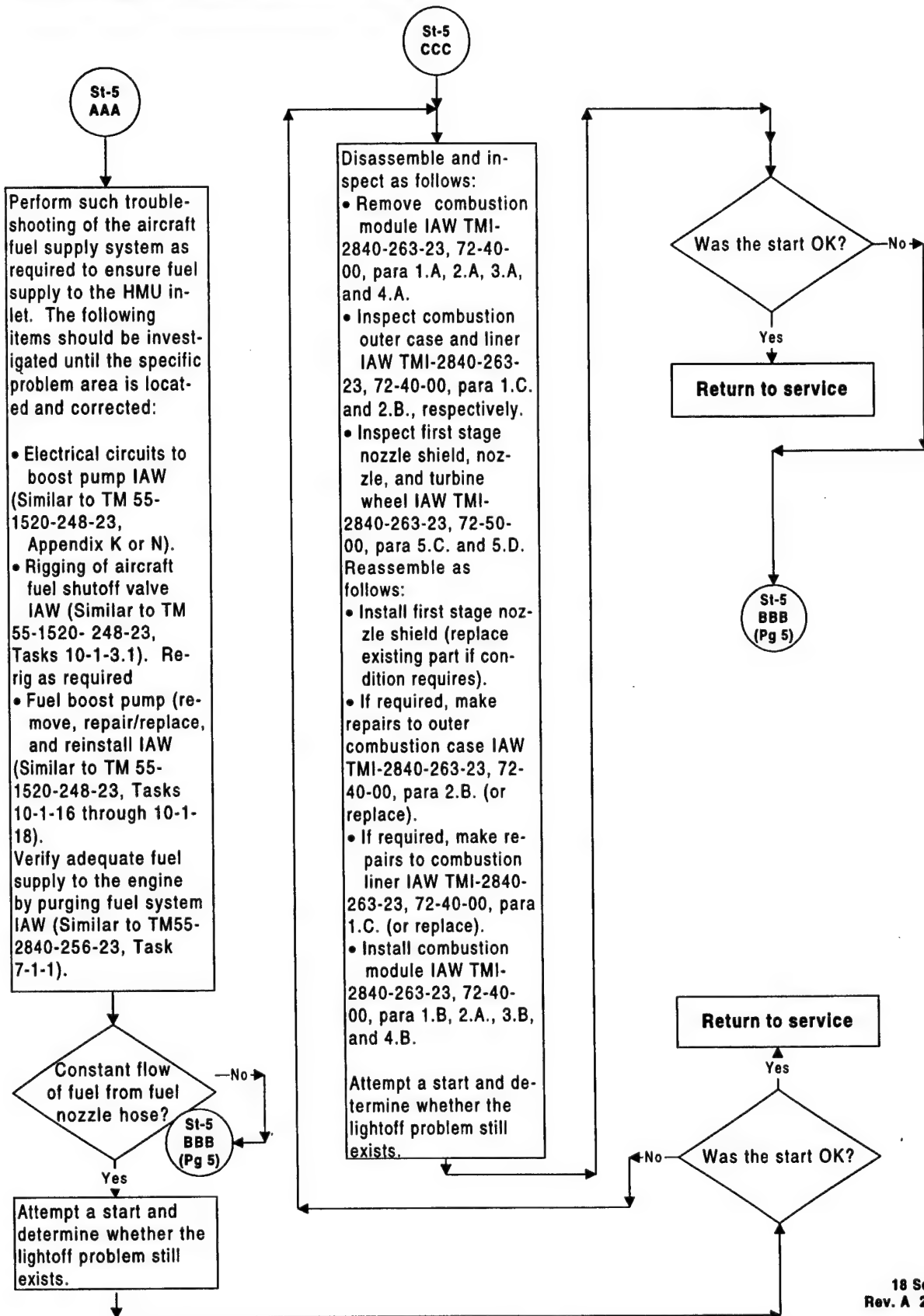


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# St-5 Motors To Required Speed But Does Not Light Off

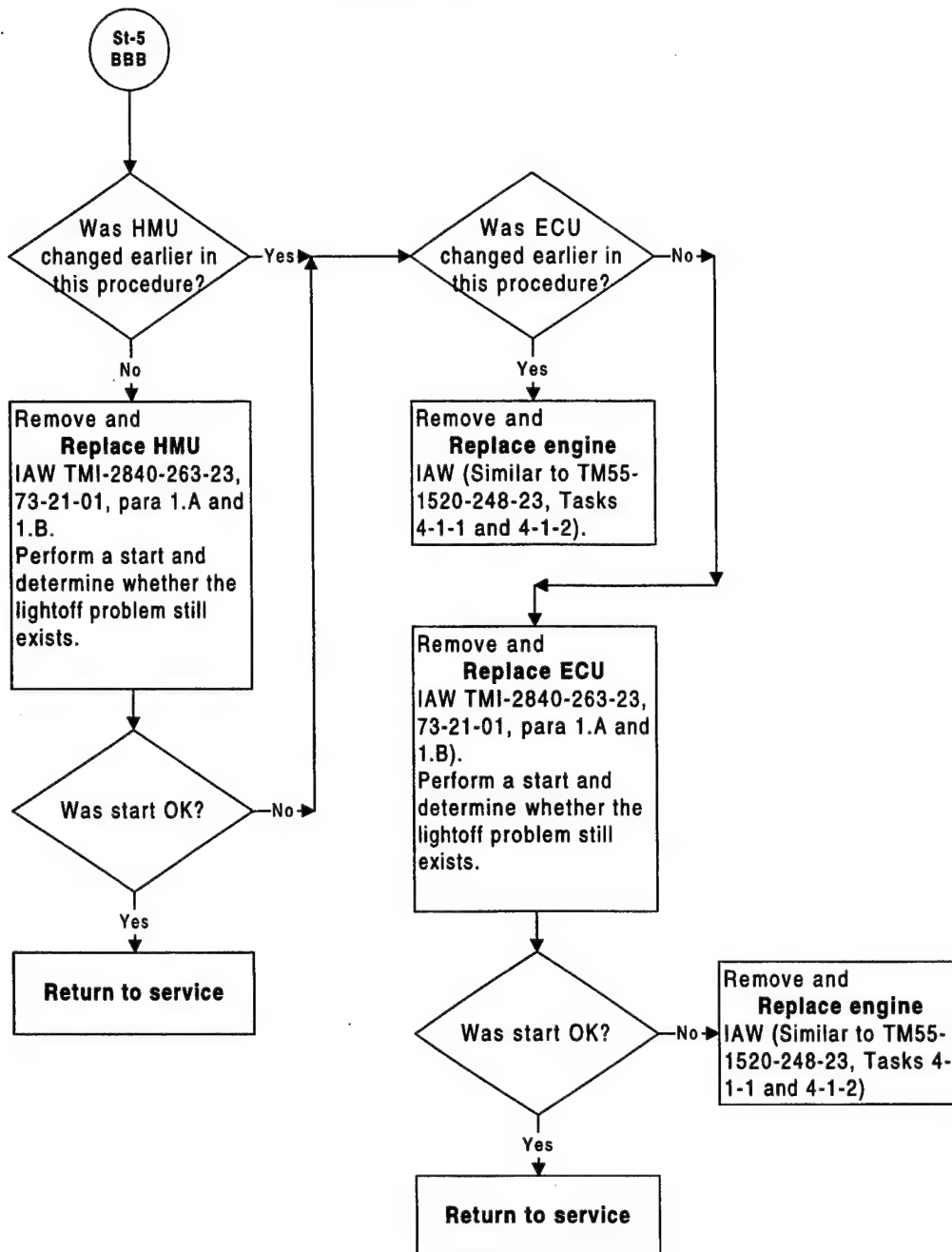


# **St-5 Motors To Required Speed But Does Not Light Off**

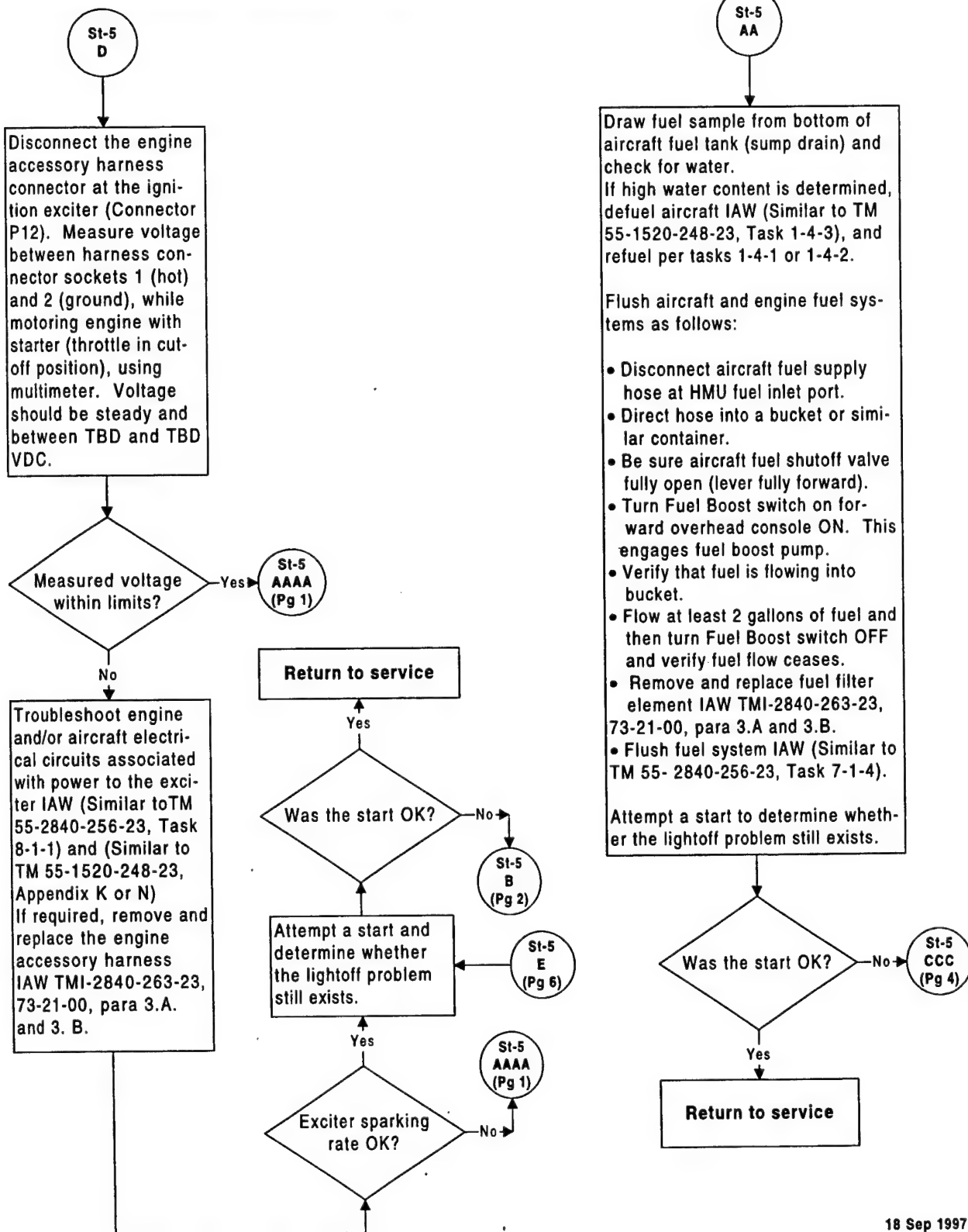


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**St-5 Motors To Required Speed  
But Does Not Light Off**



## St-5 Motors To Required Speed But Does Not Light Off





# **St-6 Lights Off Prior To Scheduled Fuel Introduction Speed**

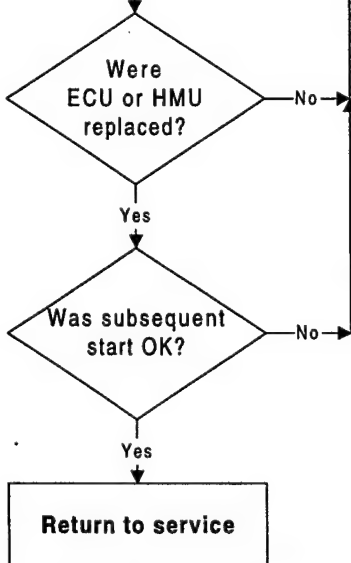
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During the normal start sequence, fuel flow is automatically initiated at 12% Ng (10% Ng at engine inlet temperatures below 20°F [-6°C]). Lightoffs occurring at lower speeds indicate a problem which may result from any of the following conditions:

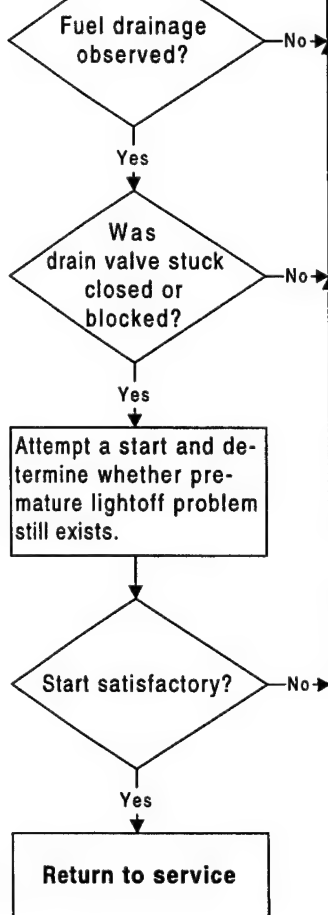
- ECU fault
- HMU fault
- Throttle linkage misrigged
- Faulty burner drain valve

If lightoffs occur at speeds below 12% Ng (10% Ng at engine inlet temperatures below 20°F), proceed as follows to correct the problem:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether premature lightoff problem still exists.

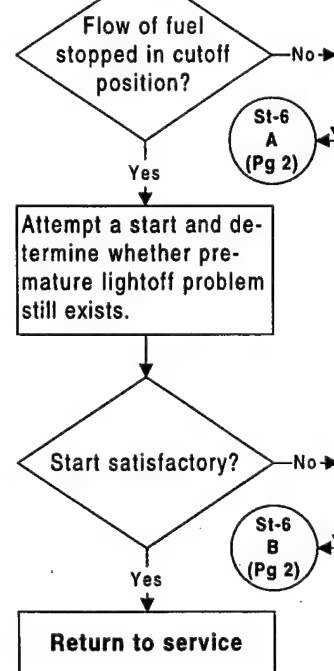


Remove, service, and reinstall burner drain valve, IAW (Similar to TMI-2840-2693-23, 72-40-00, para 3.A through 3.D. Observe for fuel drainage from burner drain port while drain valve removed.



- Inspect fuel control rigging IAW (Similar to TM 55-2840-256-23, Task 7-2-1)
- If required, re-rig throttle linkage IAW (Similar to TM 55-1520-248-23, Task 4-6-1)
- Purge fuel system IAW (Similar to TM 55-2840-256-23, Task 7-1-1).

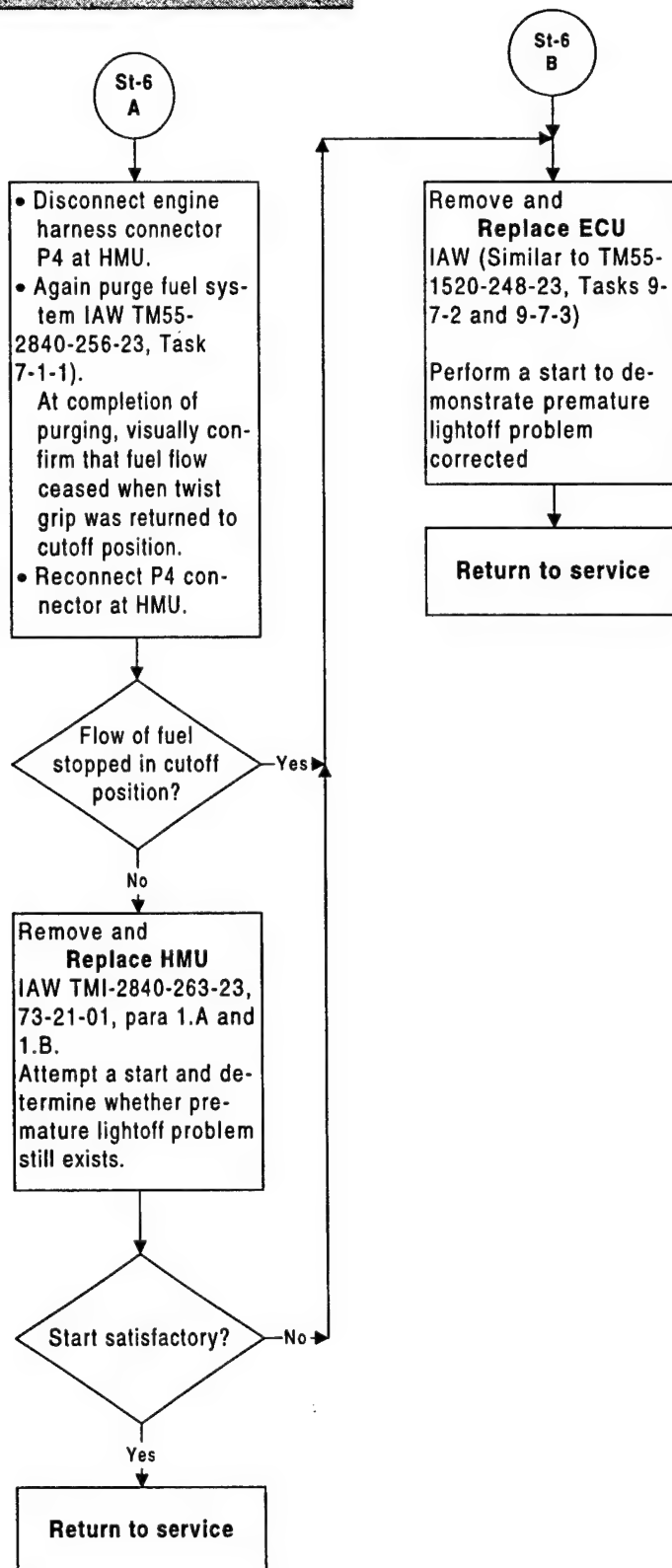
At completion of purging, visually confirm that fuel flow ceased when twist grip was returned to cutoff position.



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## St-6 Lights Off Prior To Scheduled Fuel Introduction Speed

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# **St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate**

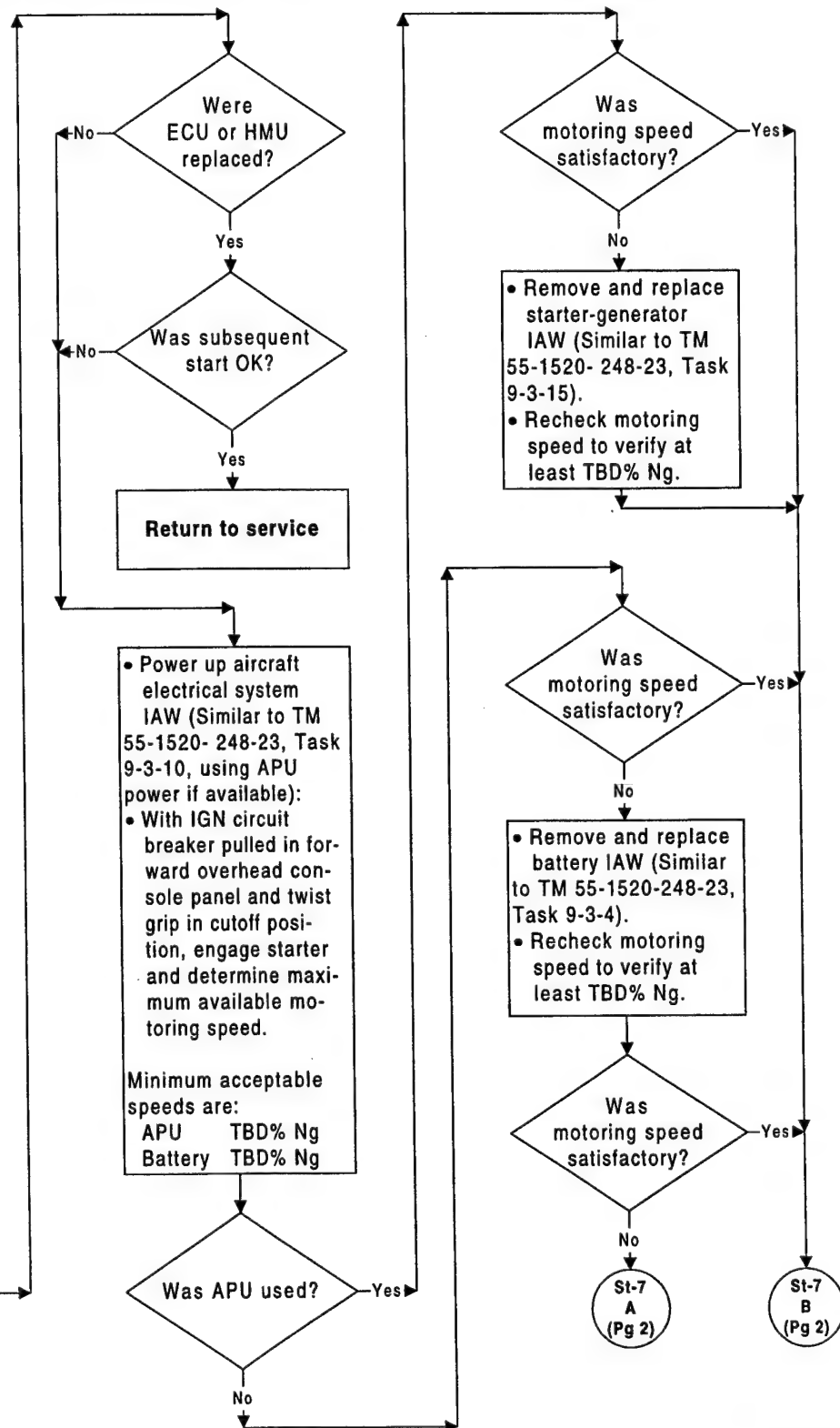
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Starts where the engine lights off satisfactorily but accelerates abnormally slowly or stagnates prior to reaching ground idle speed (64% Ng) may be the result of one or more of the following conditions:

- ECU
- HMU
- Low battery
- Degraded starter
- Inadequate engine fuel supply
- Faulty fuel nozzle
- Anti-icing system ON or leaking
- Engine bleed air extraction for aircraft cabin heating ON or leaking
- Damaged or eroded compressor

If slow or stagnated starts are experienced, proceed as follows to correct condition:

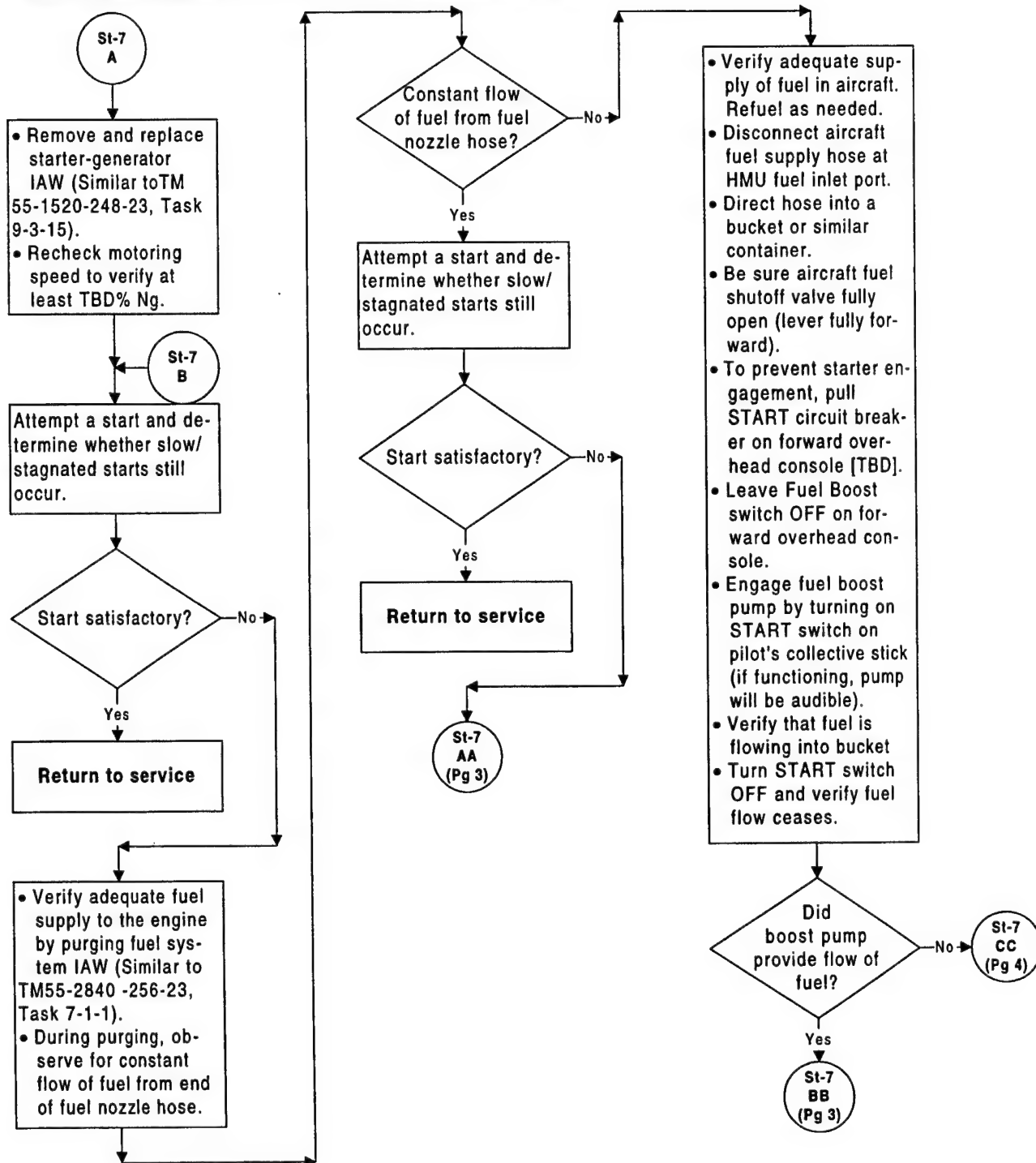
Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were re-placed as a result of clearing these faults, attempt a start and determine whether slow/stagnated starts still occur.



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# **St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate**

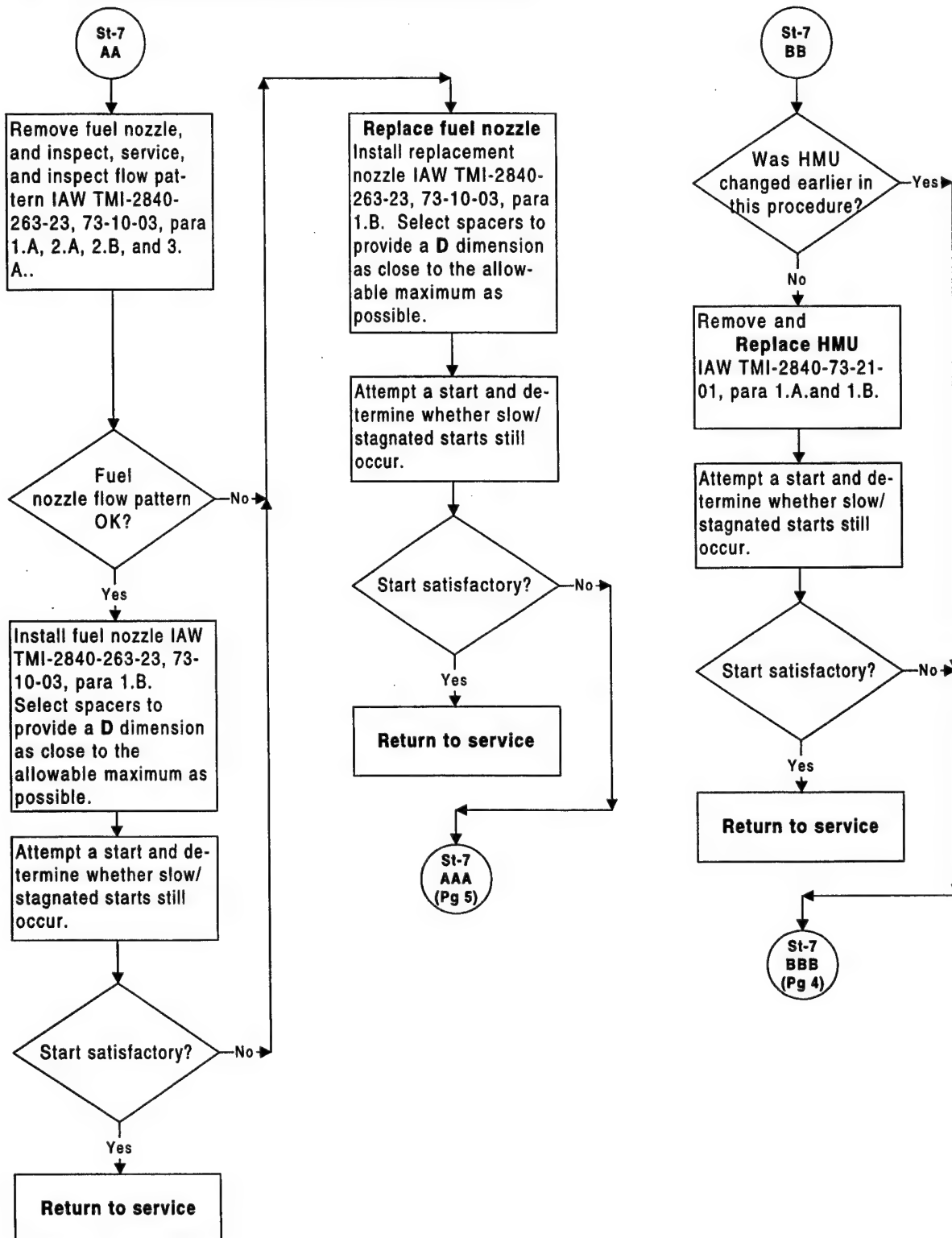
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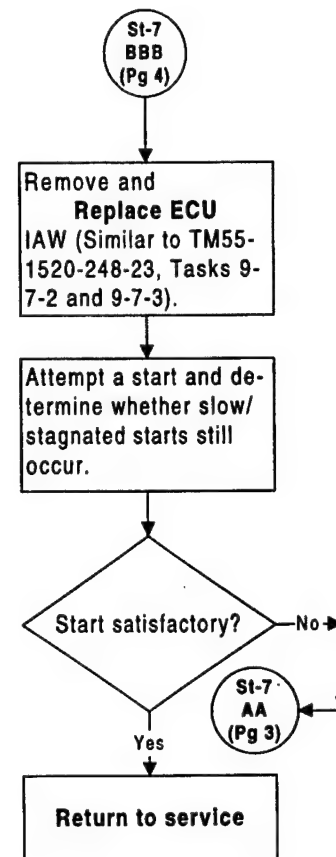
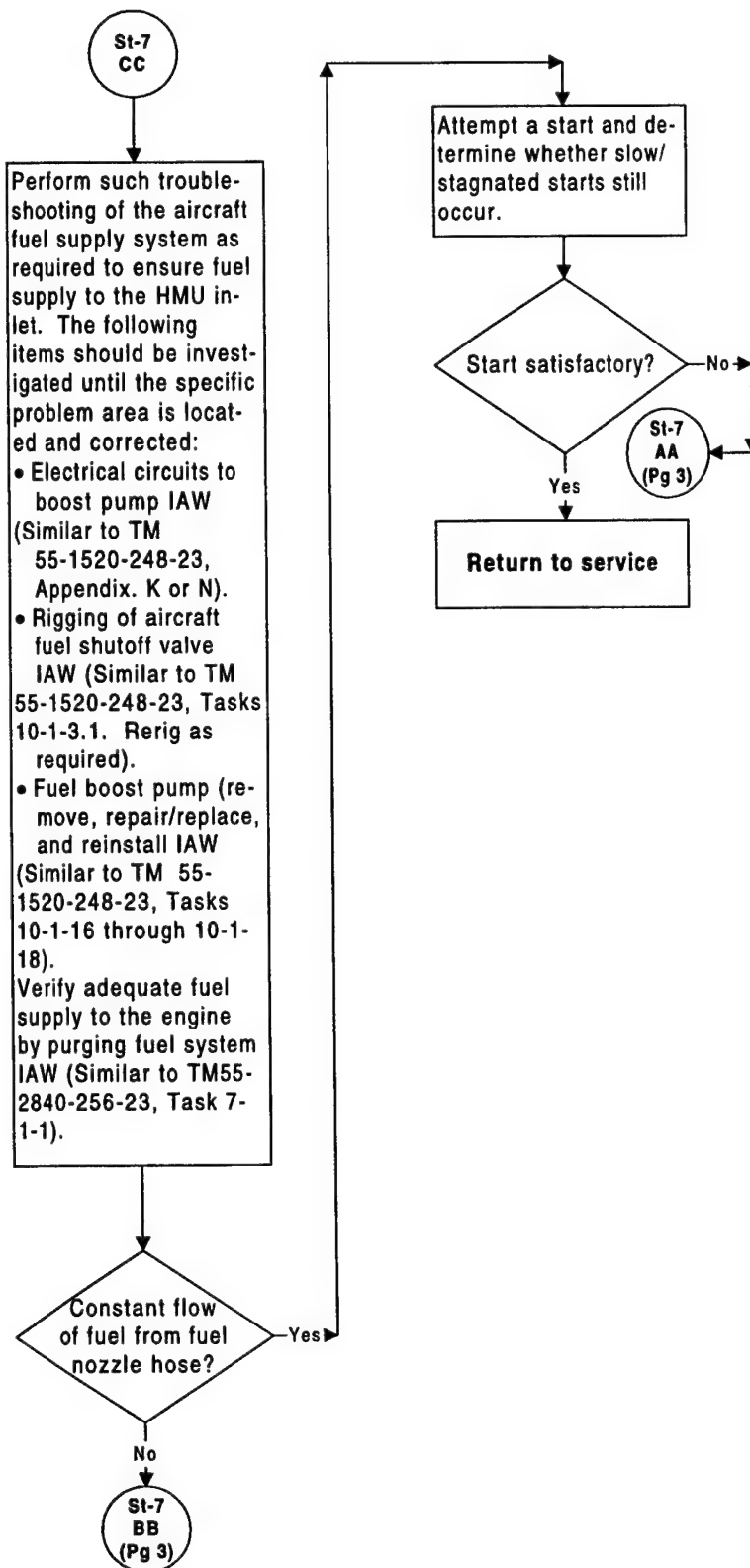
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**St-7. Lights Off But Does Not Accelerate  
To Idle At Normal Rate**



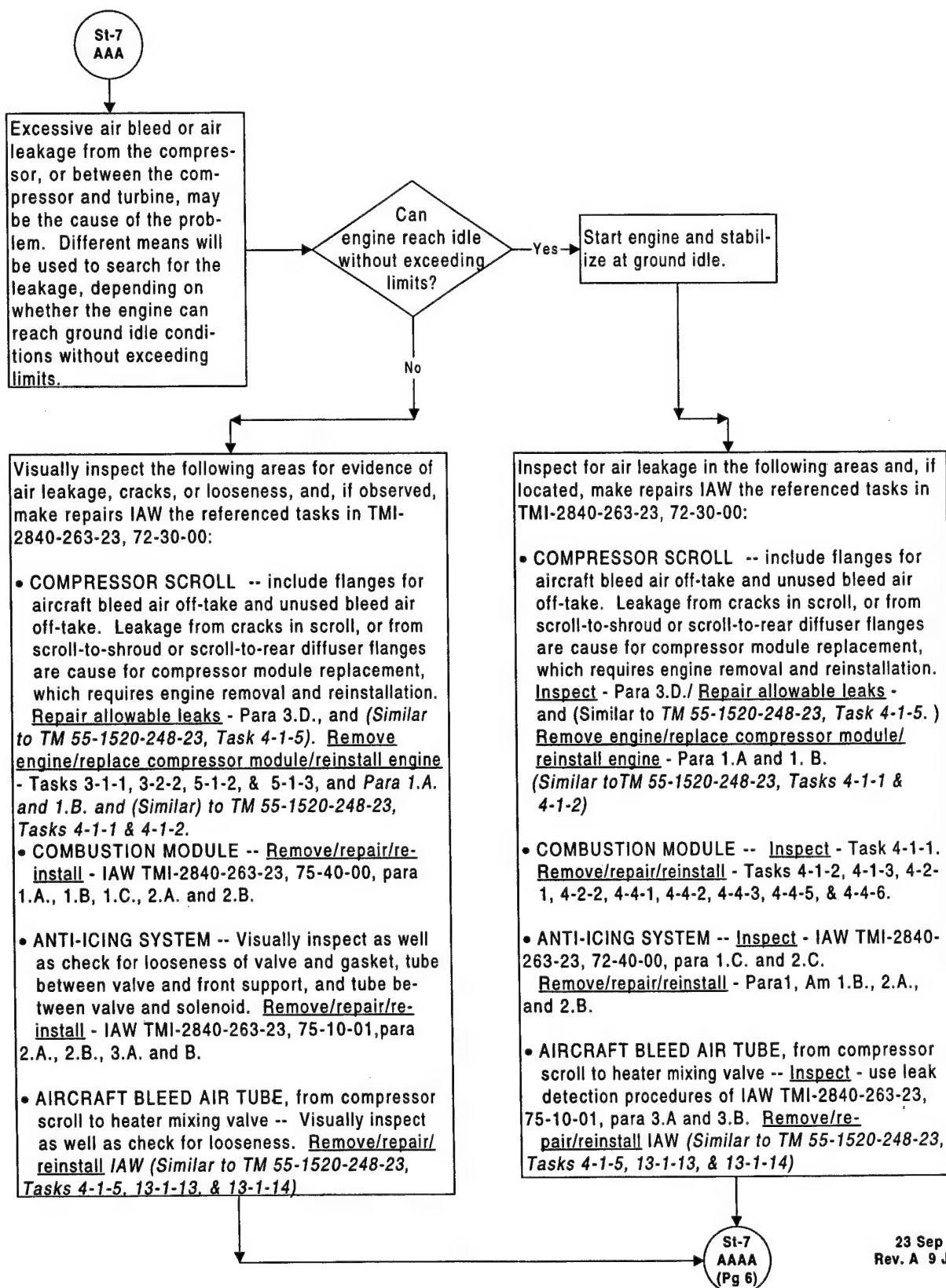
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# **St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate**

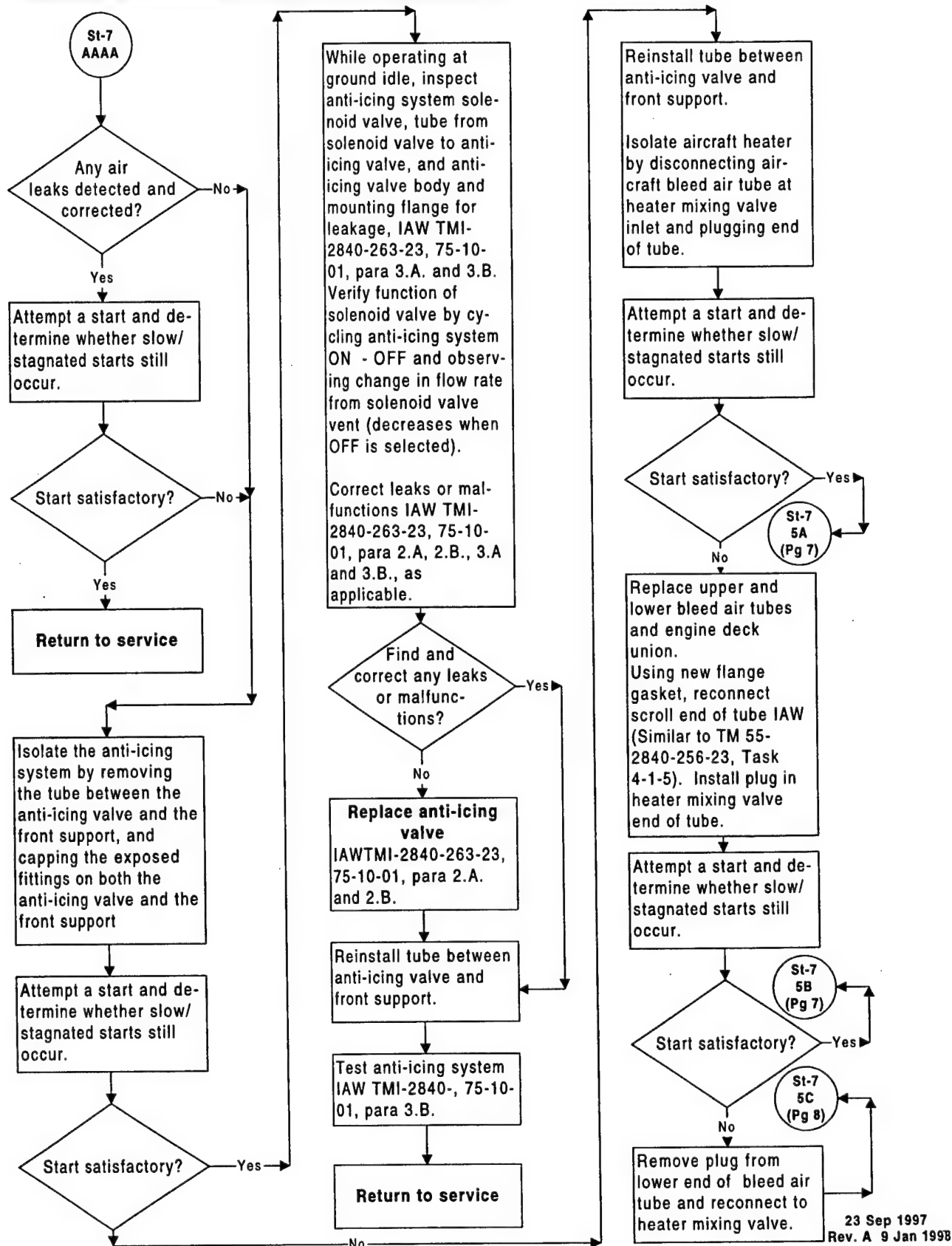


## St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

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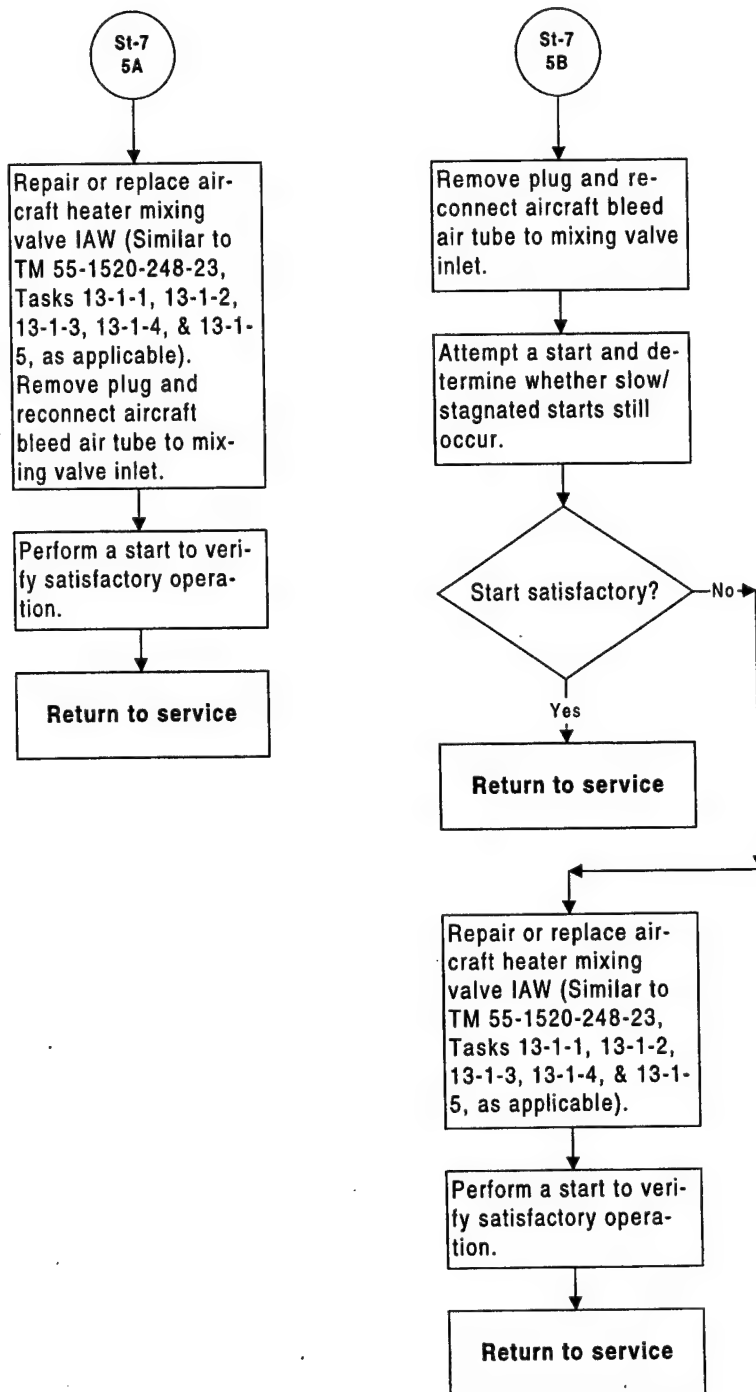
# **St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate**





## St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

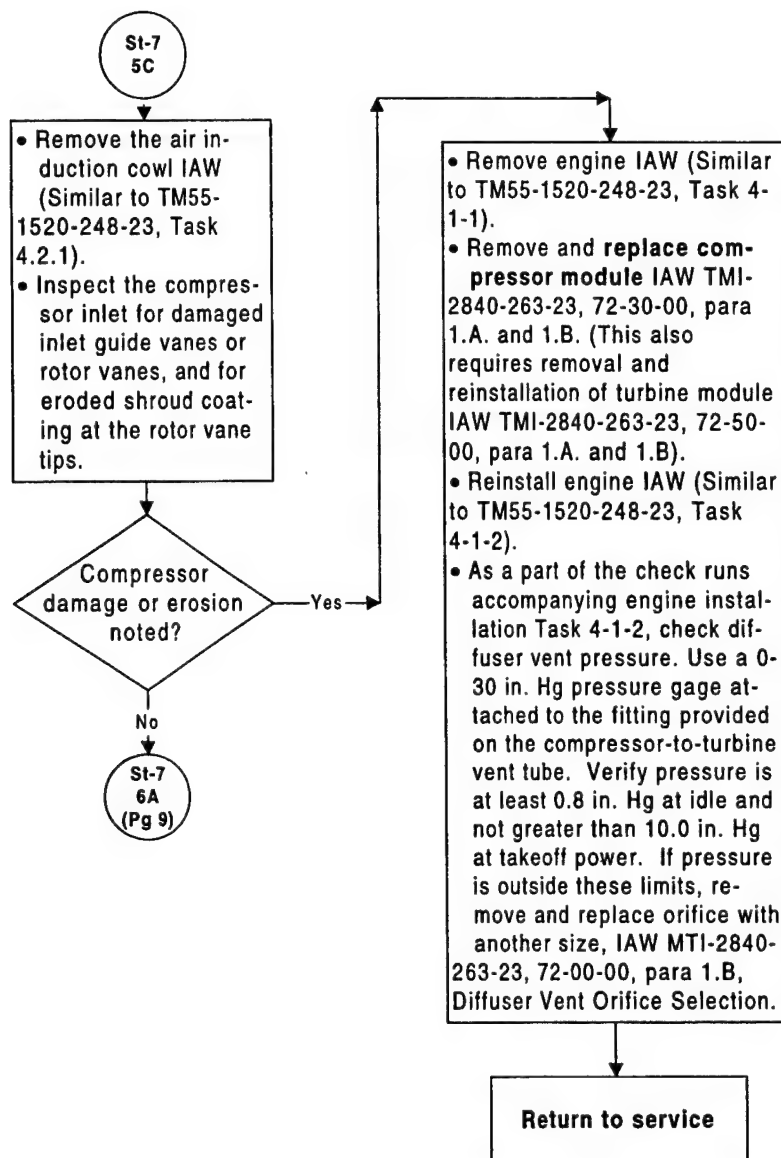
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## St-7. Lights Off But Does Not Accelerate To Idle At Normal Rate

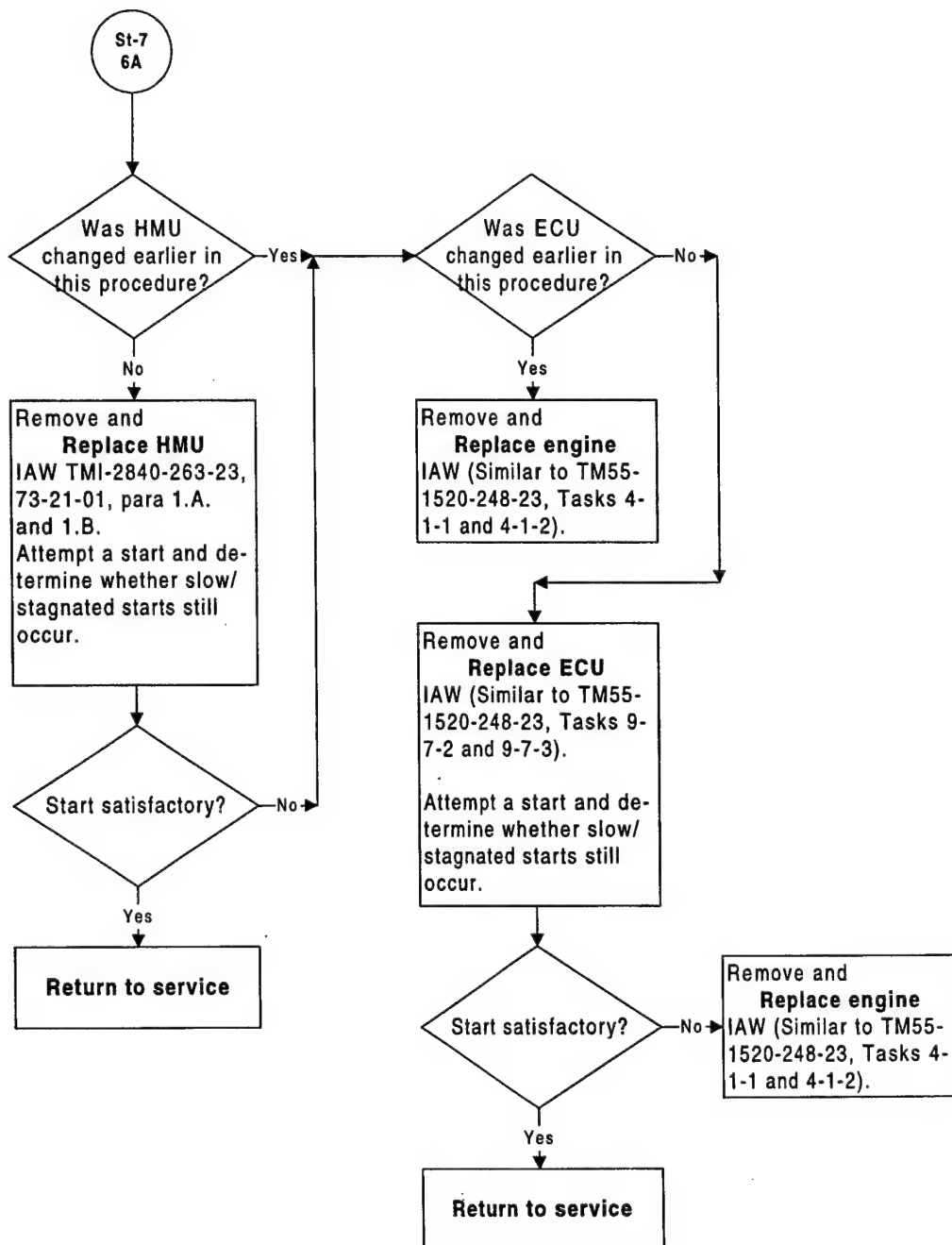
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**St-7. Lights Off But Does Not Accelerate  
To Idle At Normal Rate**

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# St-8. MGT Too High During Start

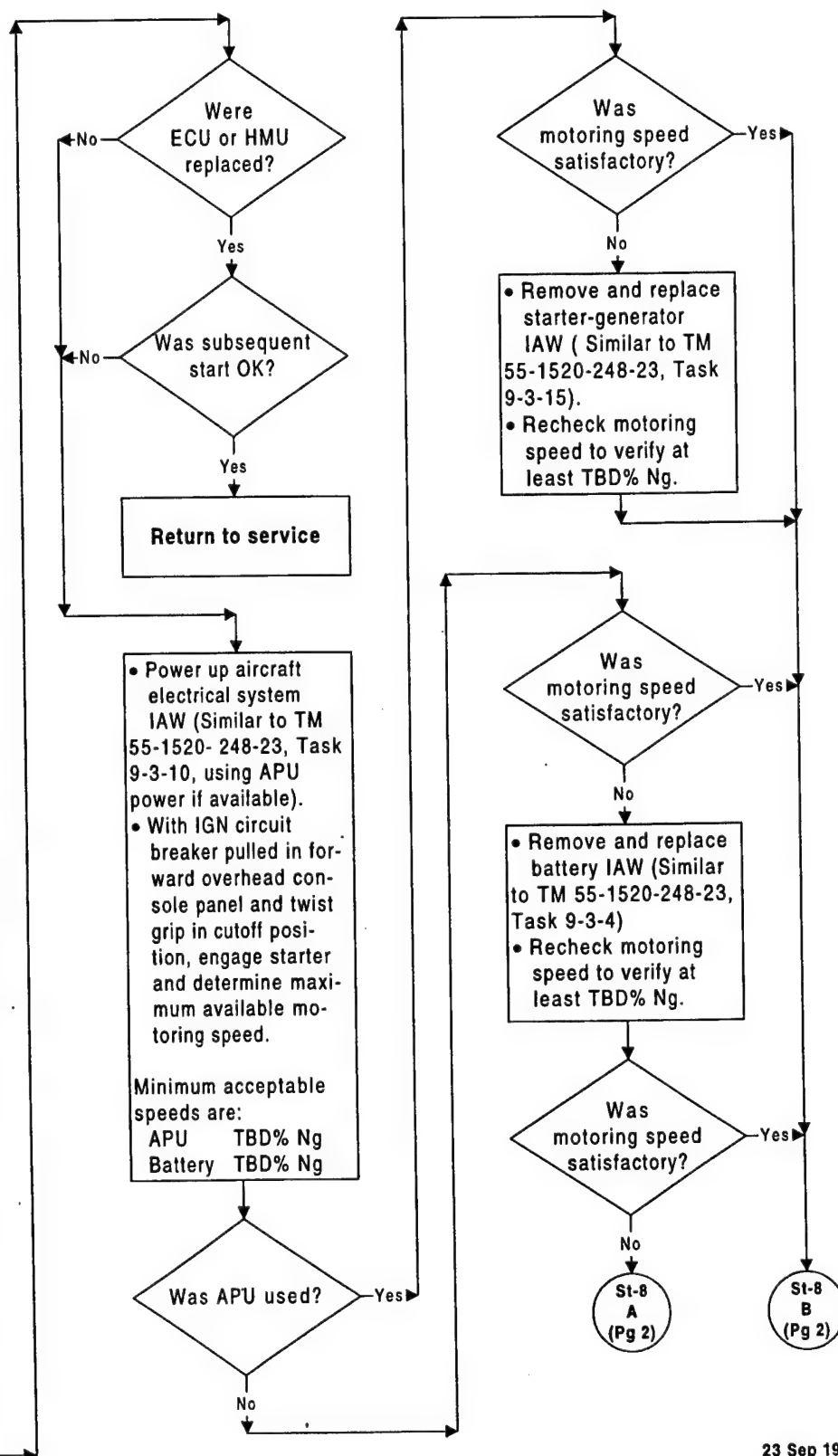
During starting, the FADEC controls Ng acceleration rate, from lightoff to ground idle. If MGT exceeds 1300°F (704°C), the acceleration rate is decreased. Starts are automatically aborted if MGT exceeds 1550°F (843°C), except at altitudes above 10,000 ft, or when MGT immediately before lightoff is above 180°F (82°C), in which cases the abort temperature is 1700°F (927°C).

Factors which could cause high starting MGT are:

- ECU
- HMU
- Insufficient fuel drainage time since last start
- High residual MGT at start initiation
- Low battery
- Degraded starter
- Faulty fuel nozzle
- Excessive compressor bleed or air leakage

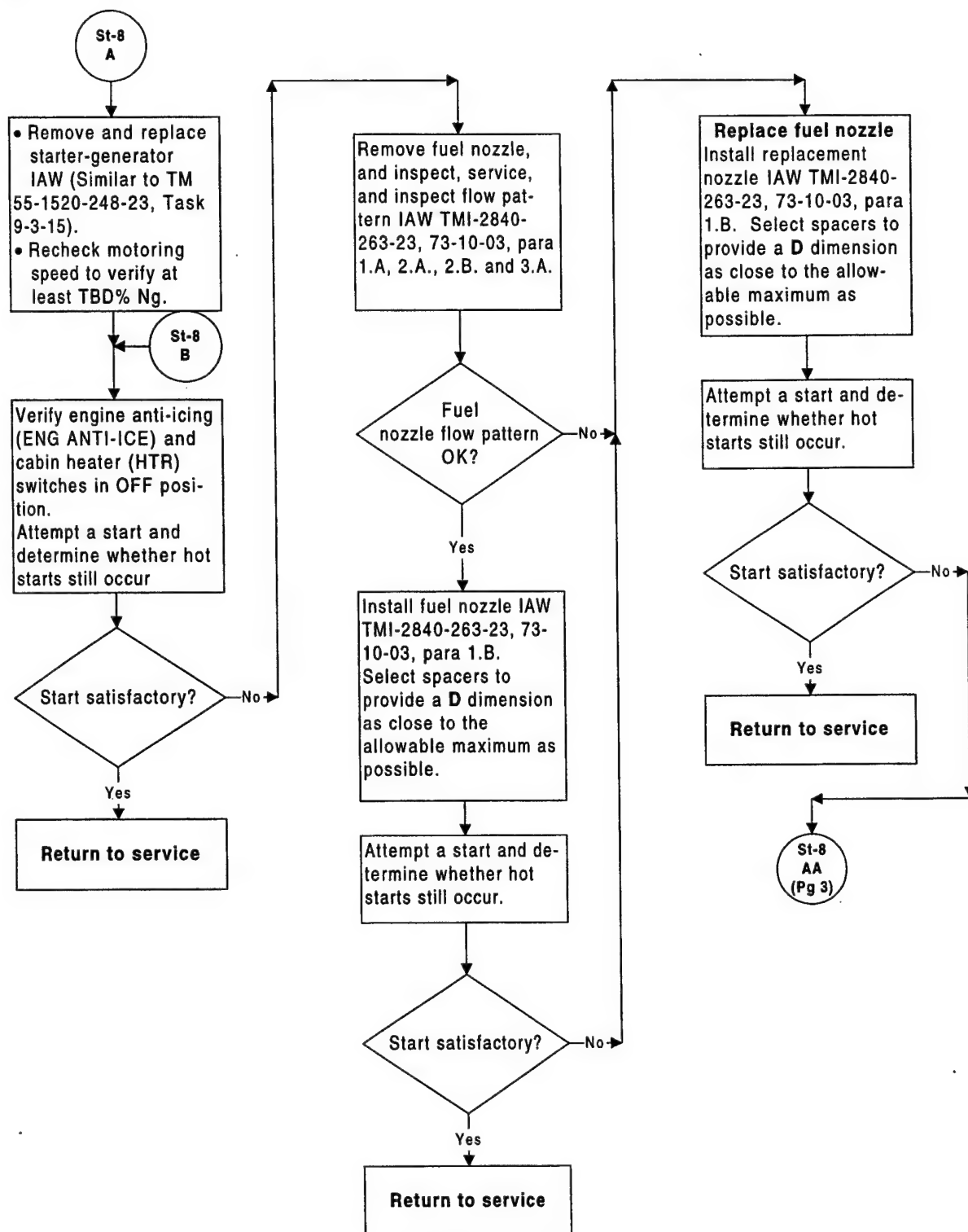
If hot starts are experienced, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether hot starts still occur.

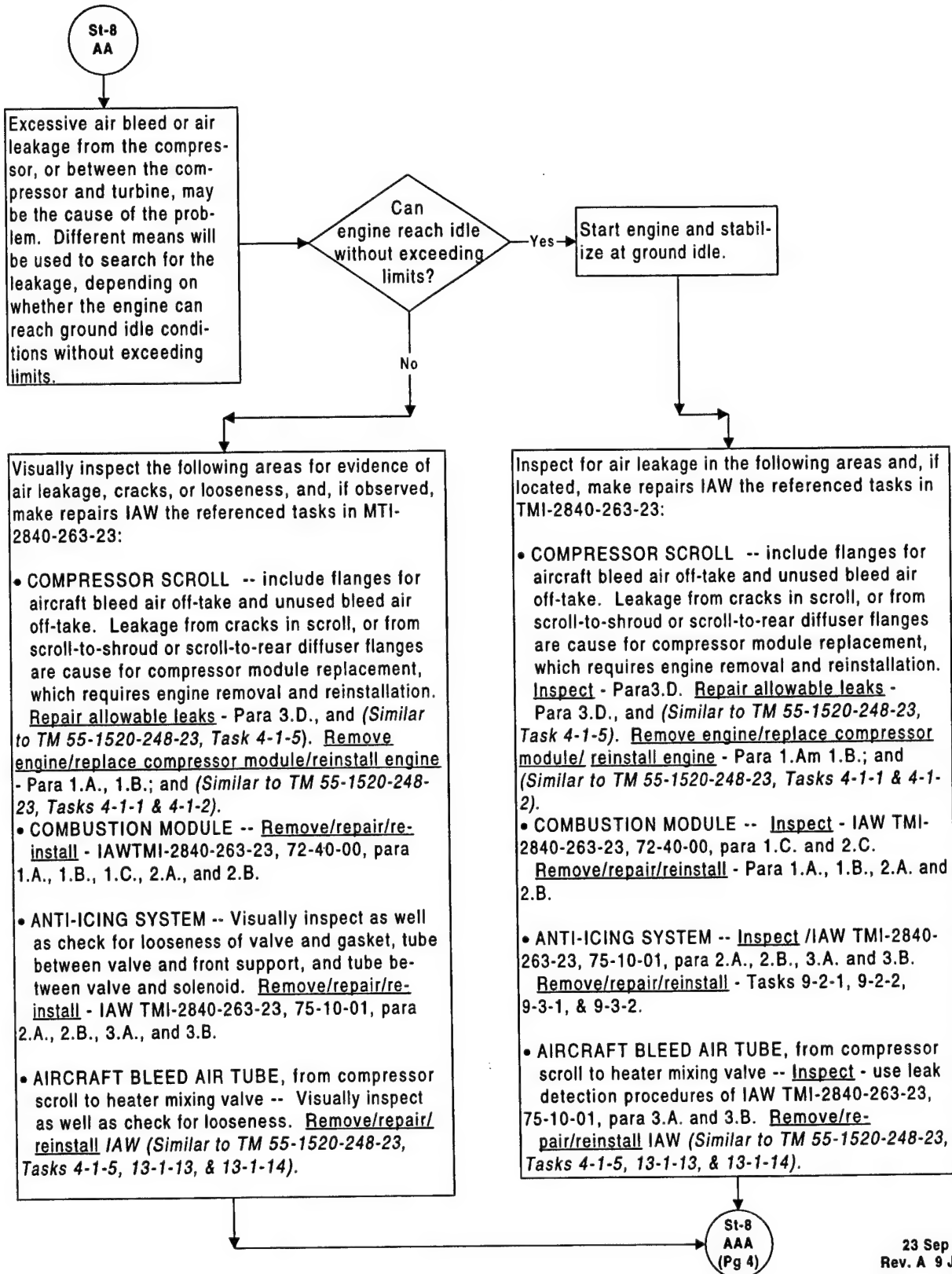


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# St-8. MGT Too High During Start

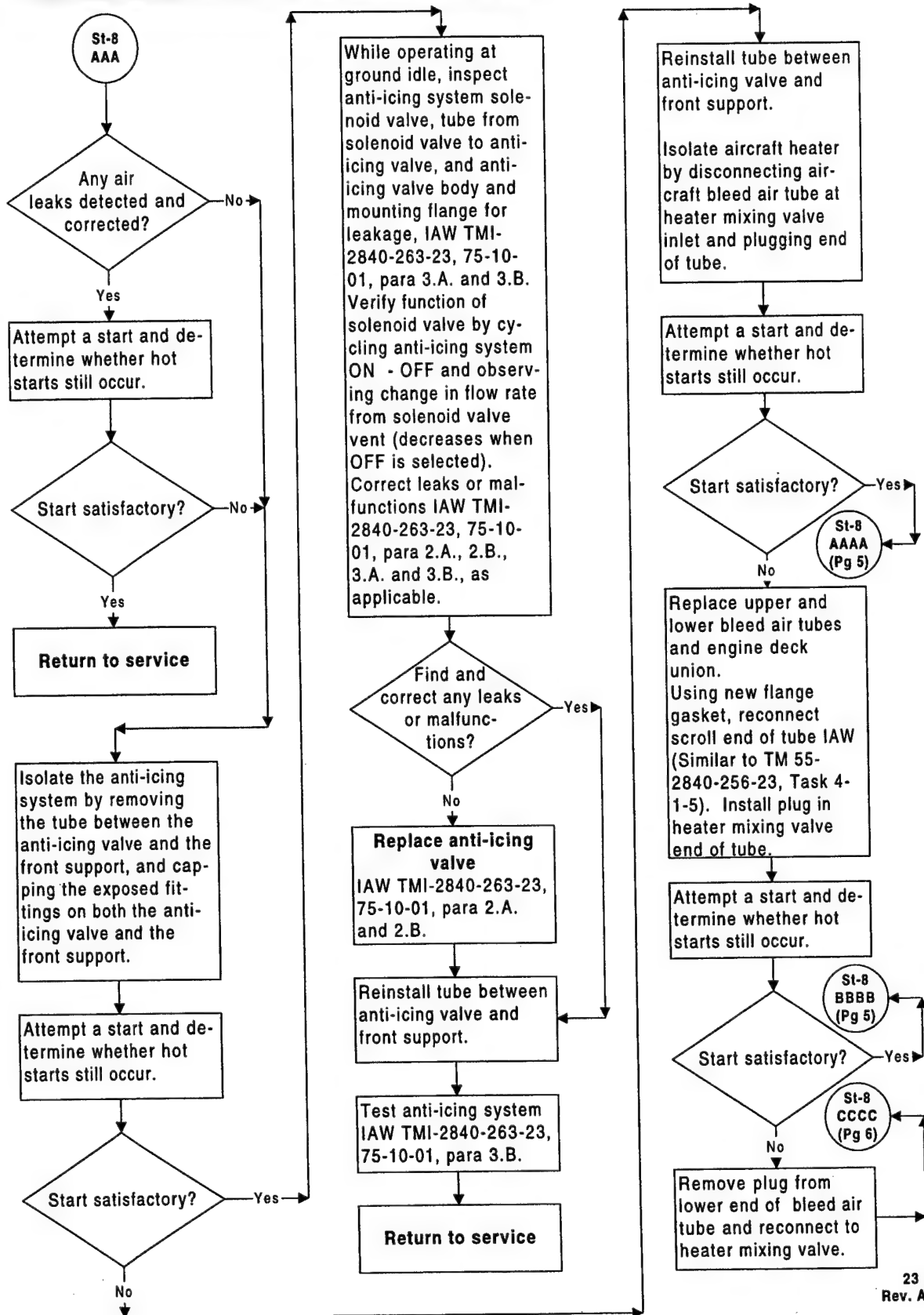


## St-8. MGT Too High During Start

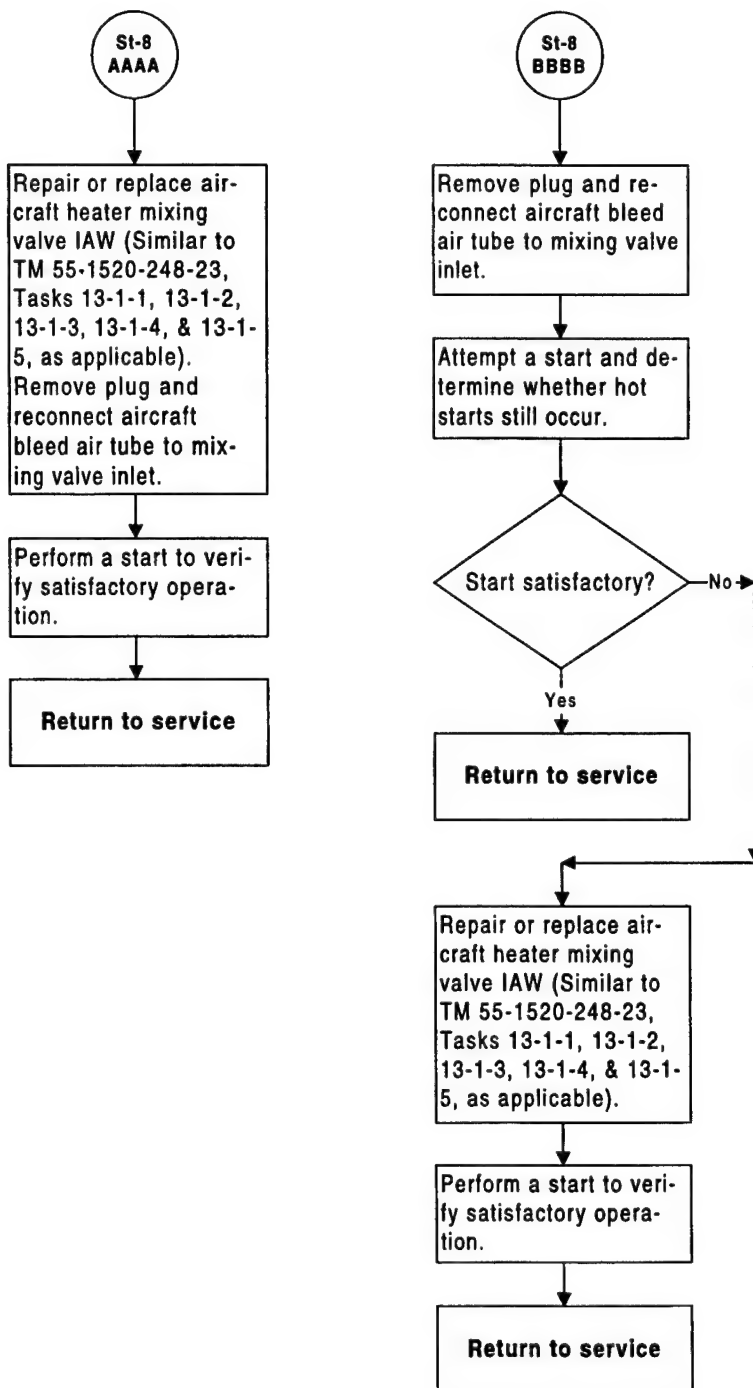


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# St-8. MGT Too High During Start

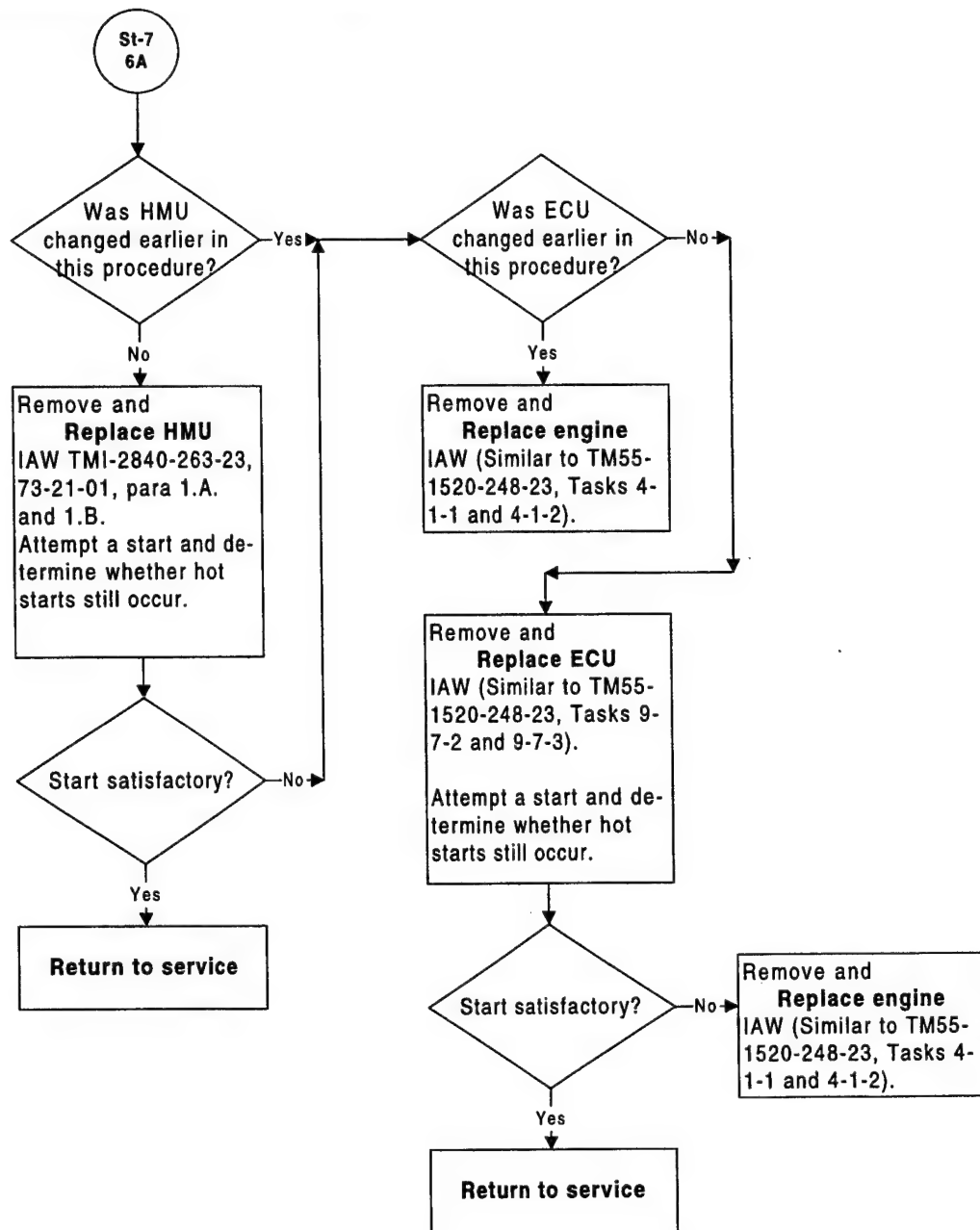


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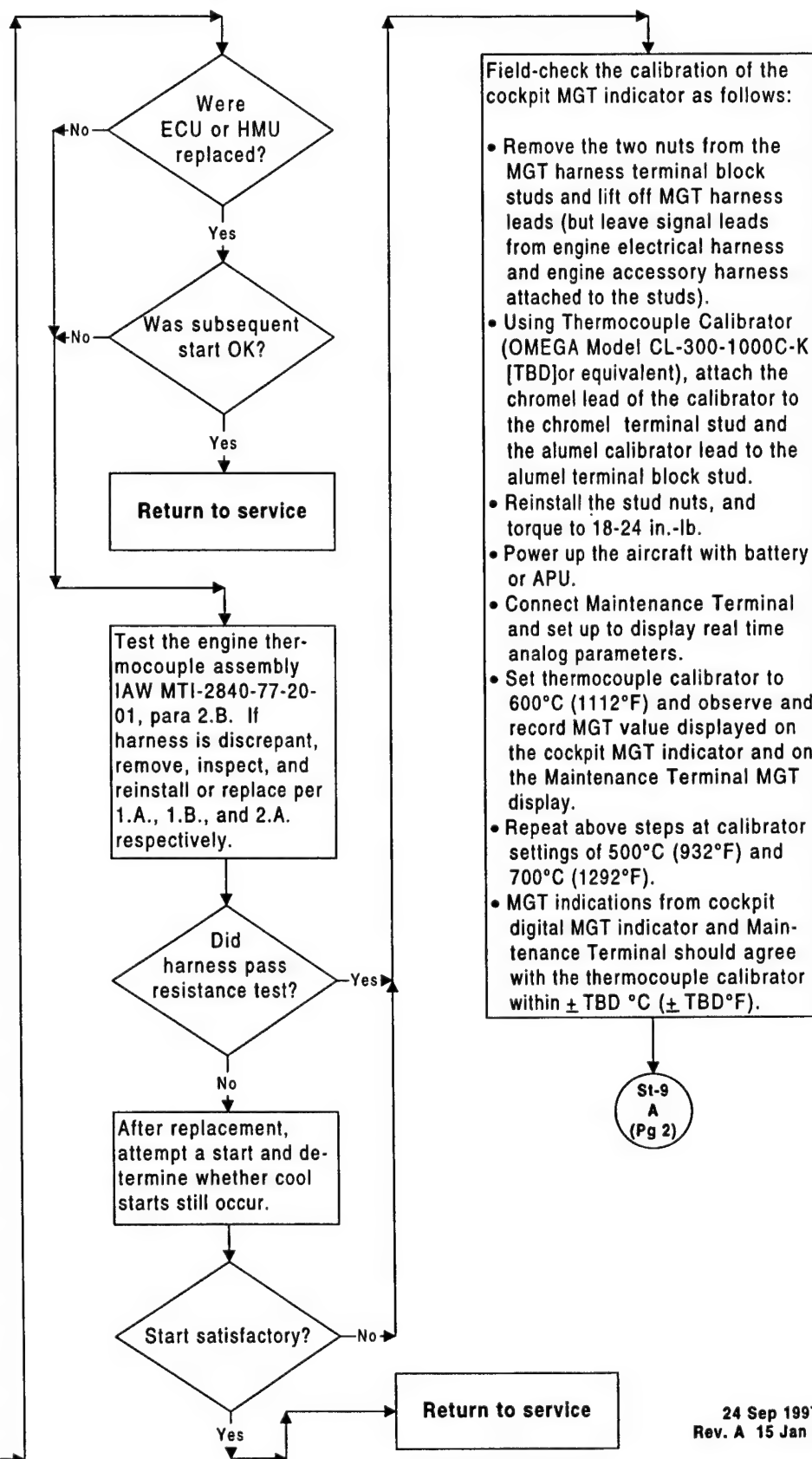
During starting, the FADEC controls Ng acceleration rate, from lightoff to ground idle. If MGT exceeds 704°C (1300°F), the acceleration rate is decreased. If MGT is below 704°C, start times to ground idle should be on the order of 30 seconds [TBD]. If start times in that vicinity are accompanied by very low MGT values (538°C [1000°F] or less), there is probably an MGT measurement error.

If a slow start time accompanies the low MGT, other factors may be involved, and should be resolved IAW procedures delineated in troubleshooting sequence St-7 (*Lights Off But Does Not Accelerate To Idle At Normal Rate*). One or more of the following items are probably responsible for the problem:

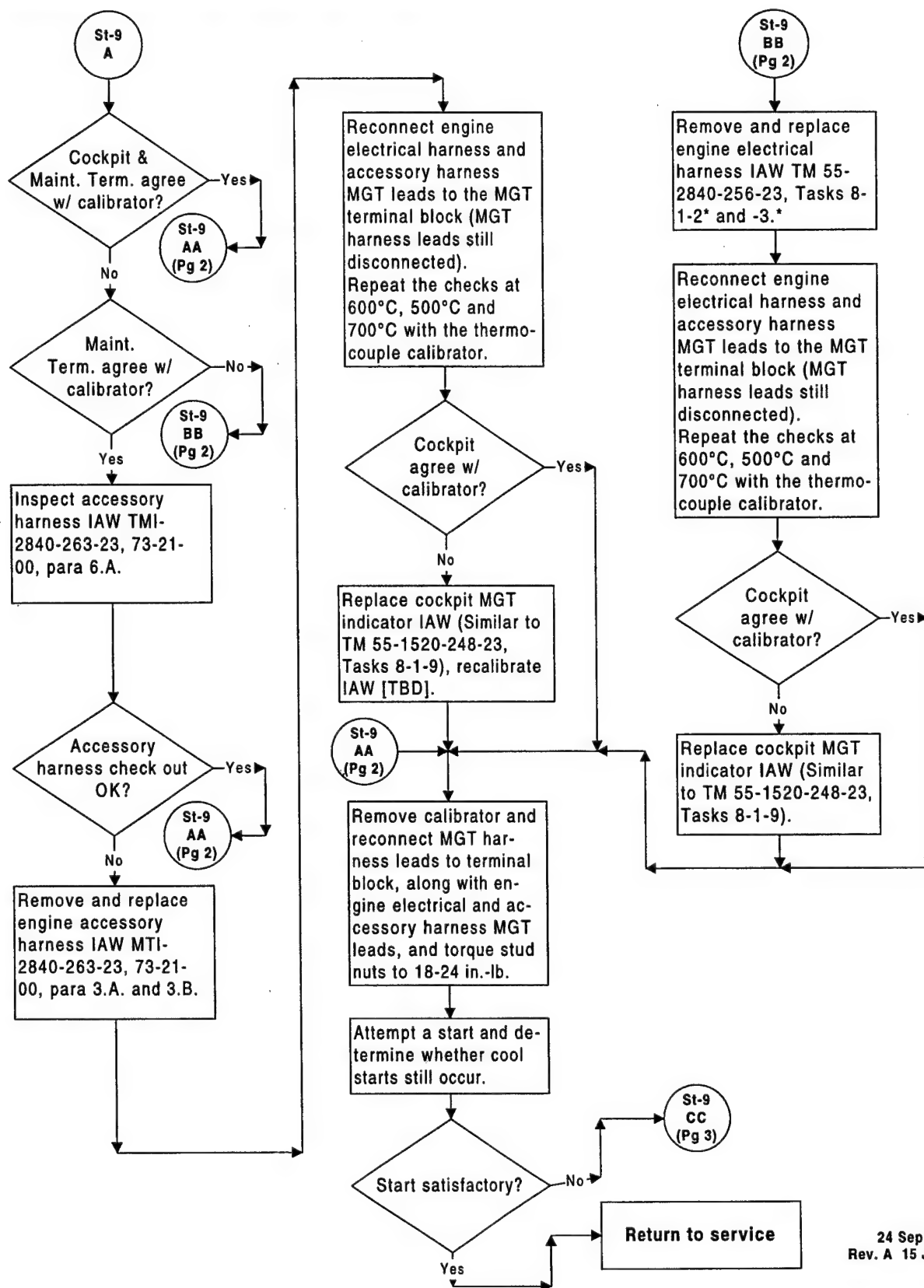
- ECU
- HMU
- Engine thermocouple harness
- Engine electrical harness
- Engine accessory harness
- Aircraft MGT indicator

If very cool starts are experienced, proceed as follows to correct condition:

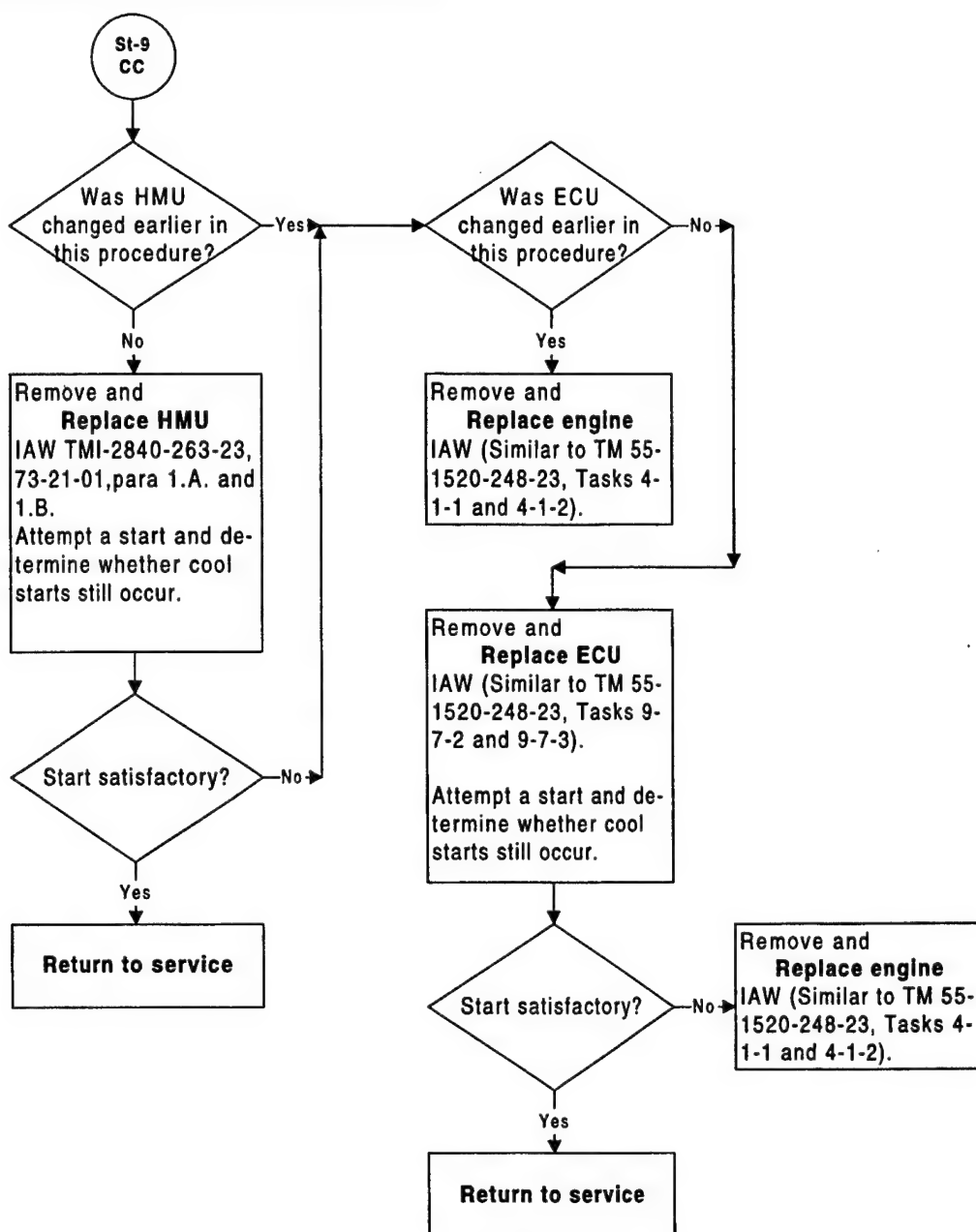
Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, attempt a start and determine whether cool starts still occur.



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# **St-10. No Oil Pressure Indicated During Start**

Page 1 of 2

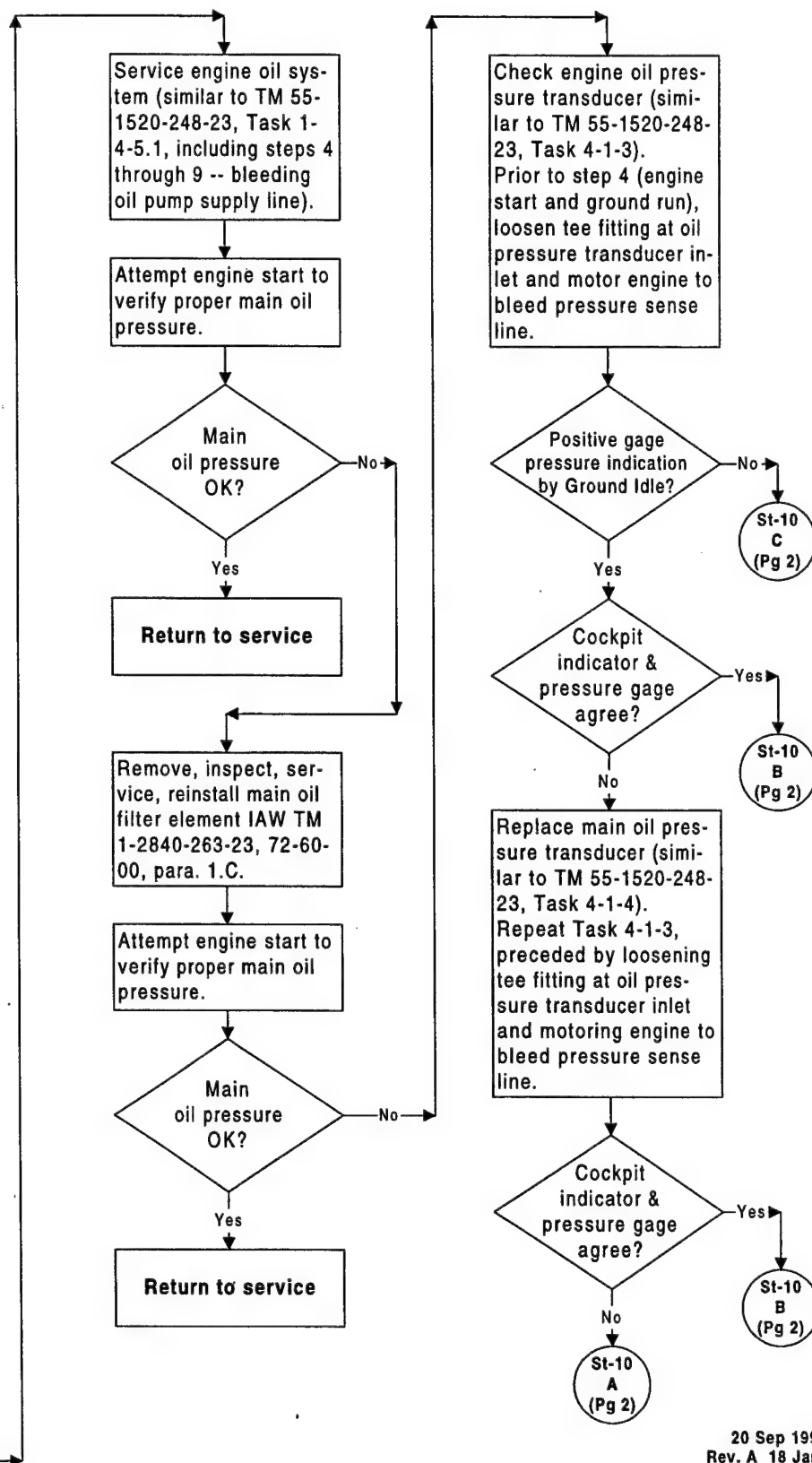
During starting, positive main oil pressure should be observed by the time Ng reaches Ground Idle speed (nominally 64%), and should stabilize at 50 to 130 psig at Ground Idle.

If no indication of main oil pressure occurs by the time Ground Idle is reached, the start must be aborted and the cause investigated and corrected.

Causes of the problem may be as follows:

- Failure of the oil pump to prime
- Restriction in oil pump supply line
- Insufficient amount of oil in oil tank
- Dirty main oil filter
- Faulty aircraft main oil pressure sensor or indicator
- Leaking O-ring on oil filter housing check valve or transfer tube
- Stuck oil pressure regulating valve
- Failed oil pump or oil pump drive
- Other accessory gearbox fault

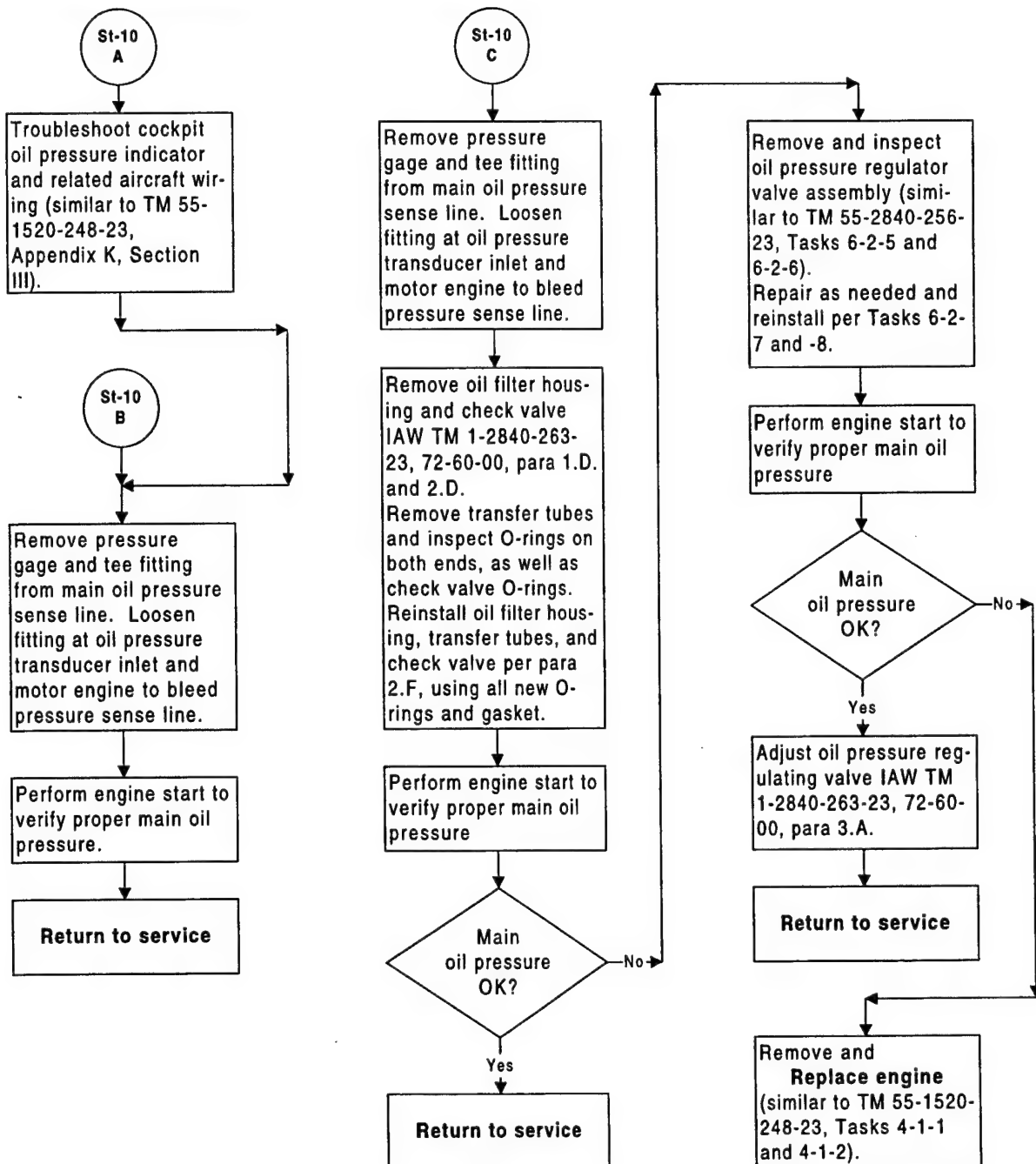
If a main oil pressure indication is observed by the time Ground Idle is reached but it stabilizes at less than 50 psig, resolve IAW procedures delineated in troubleshooting sequence R-16 (*Oil Pressure Too Low*). If no main oil pressure is observed by the time Ground Idle is reached, proceed as follows to correct.



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# **St-10. No Oil Pressure Indicated During Start**

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# **St-11. No Rotation Of Nr/Np By 25% Ng During Start**

Page 1 of 2

During engine starts, rotation of the aircraft rotor should begin by the time Ng reaches 25%. If no rotation, the start must be aborted and the cause investigated.

Possible causes for the problem include the following:

- Improper oil type in cold weather
- Excess drag in aircraft power train
- Rub or drag in engine power turbine system
- Accessory gearbox internal fault

If this problem is encountered, proceed as follows:

Is ambient temperature below -40°C (-40°F)?

Yes

Verify from engine log book that oil conforming to MIL-L-7808G is being used in the engine. If not, change oil to MIL-L-7808G IAW TMI-2840-263-23, 72-00-00, para 8.D. Engine Servicing. This includes draining and servicing the engine oil system IAW (Similar to TM 55-1520-248-23, Tasks 1-4-5 and 1-4-5.1).

St-11  
A  
(Pg 1)

Was oil changed to MIL-L-7808G?

Yes

Attempt a start and verify proper Nr/Np rotation.

Start satisfactory?

Yes

Return to service

St-11  
A

Attempt to walk aircraft rotor backwards (opposite to normal direction of rotation). Do not use excessive force.

Did rotor rotate freely or become free?

Yes

Attempt a start and verify proper Nr/Np rotation.

Start satisfactory?

Yes

Return to service

St-11  
C  
(Pg 2)

Disconnect the engine to transmission drive shaft IAW (Similar to TM 55-1520-248-23, Task 6-2-2). Attempt to rotate the engine by hand through the engine drive shaft coupling.

Able to rotate engine?

Yes

Troubleshoot and repair aircraft power train IAW (Similar to TM 55-1520-248-23, Chapter 6).

Return to service

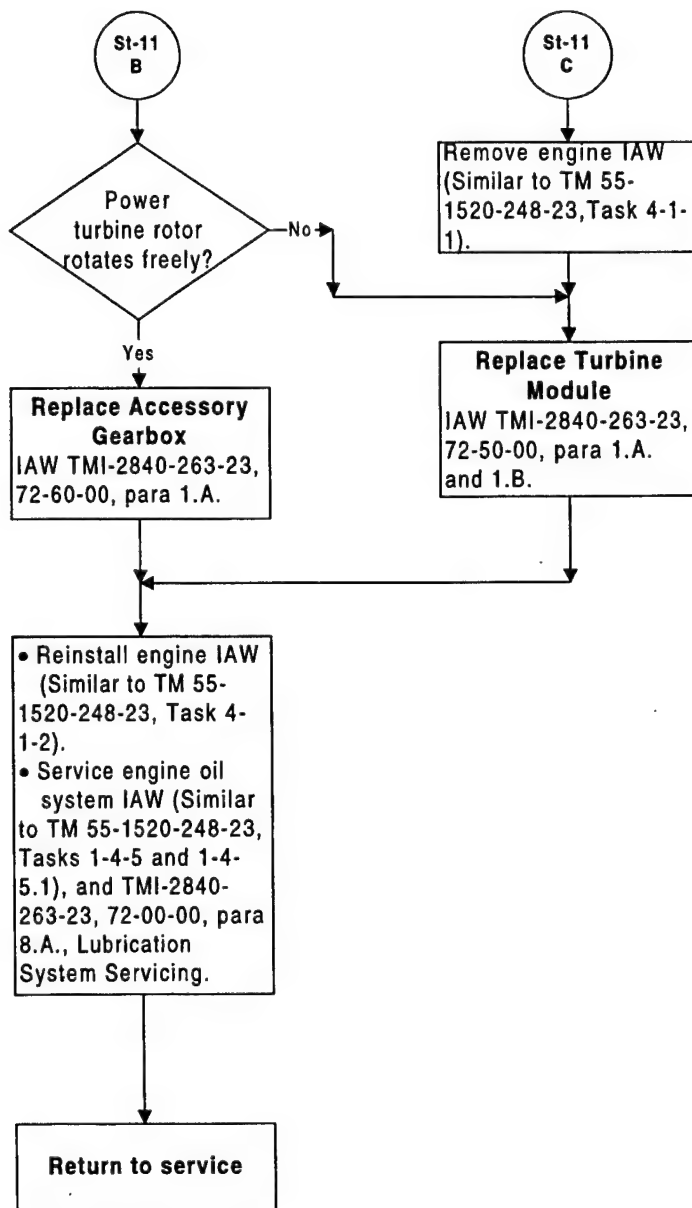
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.
- Check power turbine rotor for freedom of rotation.

St-11  
B  
(Pg 2)

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**St-11. No Rotation Of Nr/Np By  
25% Ng During Start**

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# St-12. Does Not Motor To Required Lightoff Speed

Page 1 of 3

During starting, the FADEC introduces fuel at 12% Ng (10% Ng at ambient temperatures below 20°F [-6.7°C]). If the maximum available motoring speed is less than these speeds, there will be no fuel flow and thus the engine will not light off. The starter should be able to motor the engine to at least 15% Ng at 20°F and above, and to 12% Ng below 20°F.

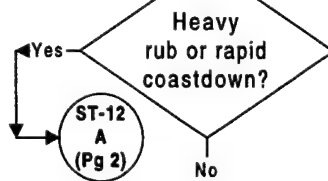
Possible causes for low motoring speed are:

- Low battery
- Degraded starter
- Aircraft electrical system problems
- Mechanical drag or rub in gas generator rotor
- Excess oil in accessory gearbox creating drag on gears

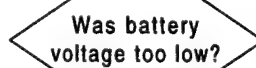
If low motoring speed is encountered, proceed as follows:

- Power up aircraft electrical system IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- On Multi-Parameter Display (MPD) unit, select **BATT V - START V**, to allow monitoring of battery and starter voltages.
- Pull IGN circuit breaker on forward overhead console panel and set twist grip to cutoff position.

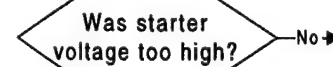
- Engage starter and determine maximum available motoring speed.
- Note battery voltage prior to starter engagement and starter voltage at maximum cranking speed.
- Disengage starter and, during coast-down, listen for heavy rubbing noises from the engine and observe for an unusually rapid stop.



Battery voltage before starter engagement should be at least TBD volts, and starter voltage at maximum cranking speed should be between TBD and TBD volts



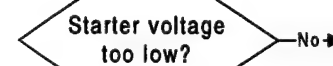
Remove and replace battery IAW (Similar to TM 55-1520-248-23, Task 9-3-4).



Remove and replace starter-generator IAW (Similar to TM 511520-248-23, Task 9-3-15).

Motor to verify at least minimum required Ng.

Return to service



Troubleshoot and repair aircraft starter electrical system, IAW TM 55-1520-248-23, Appendix K, Section IV.

Motor to verify at least minimum required Ng.

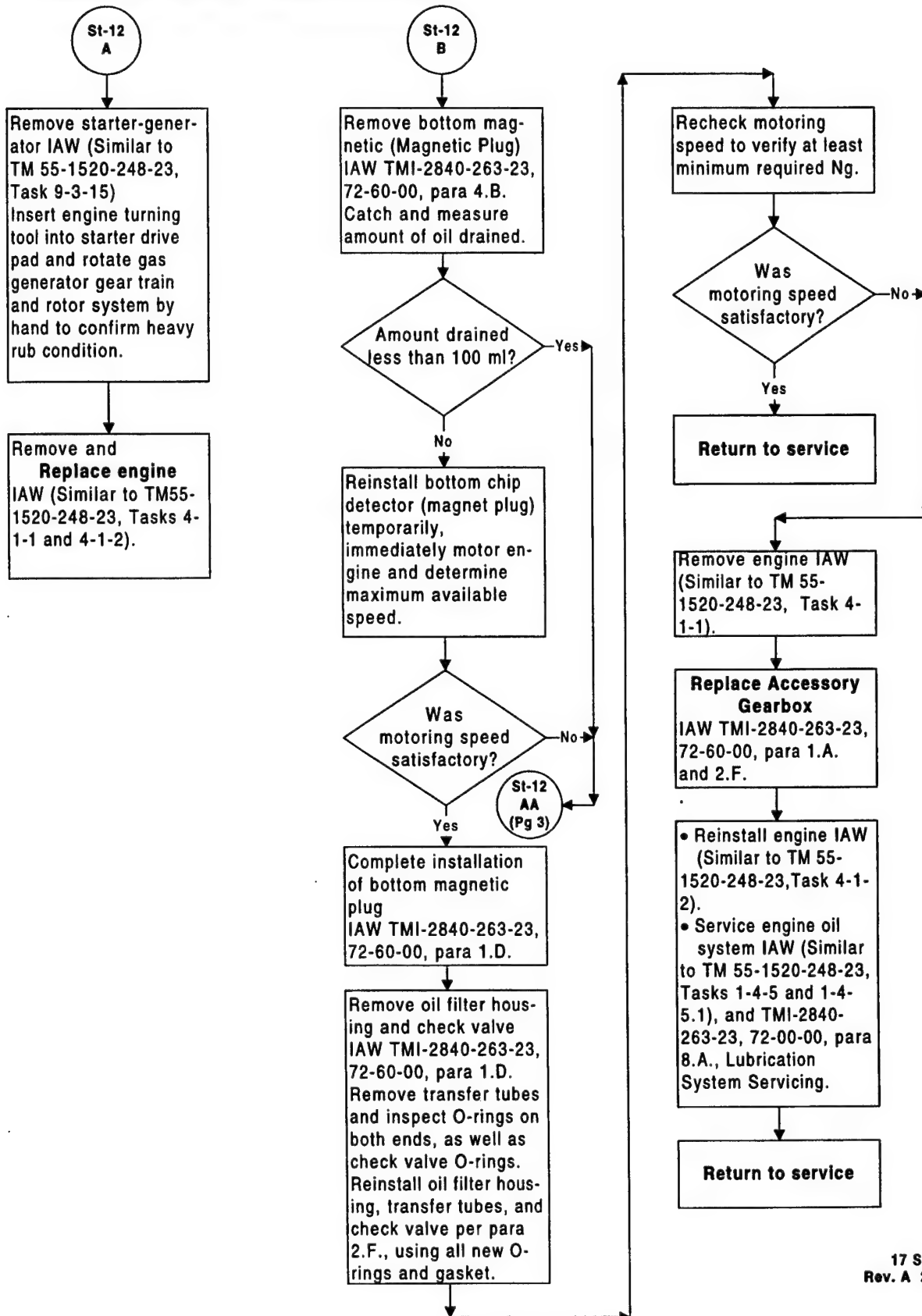
Return to service

Motor to verify at least minimum required Ng.

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# St-12. Does Not Motor To Required Lightoff Speed

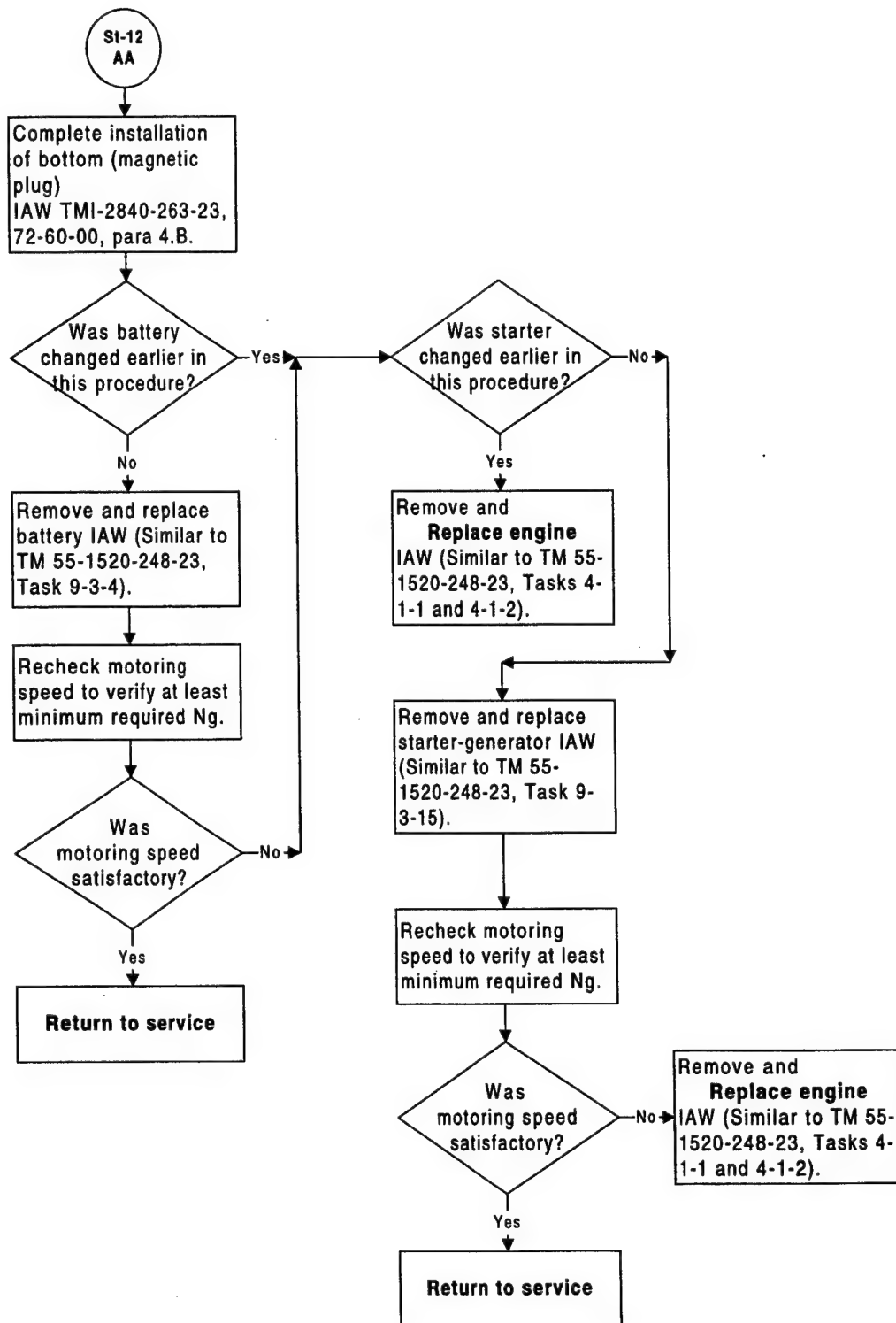
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## St-12. Does Not Motor To Required Light Off Speed

Page 3 of 3



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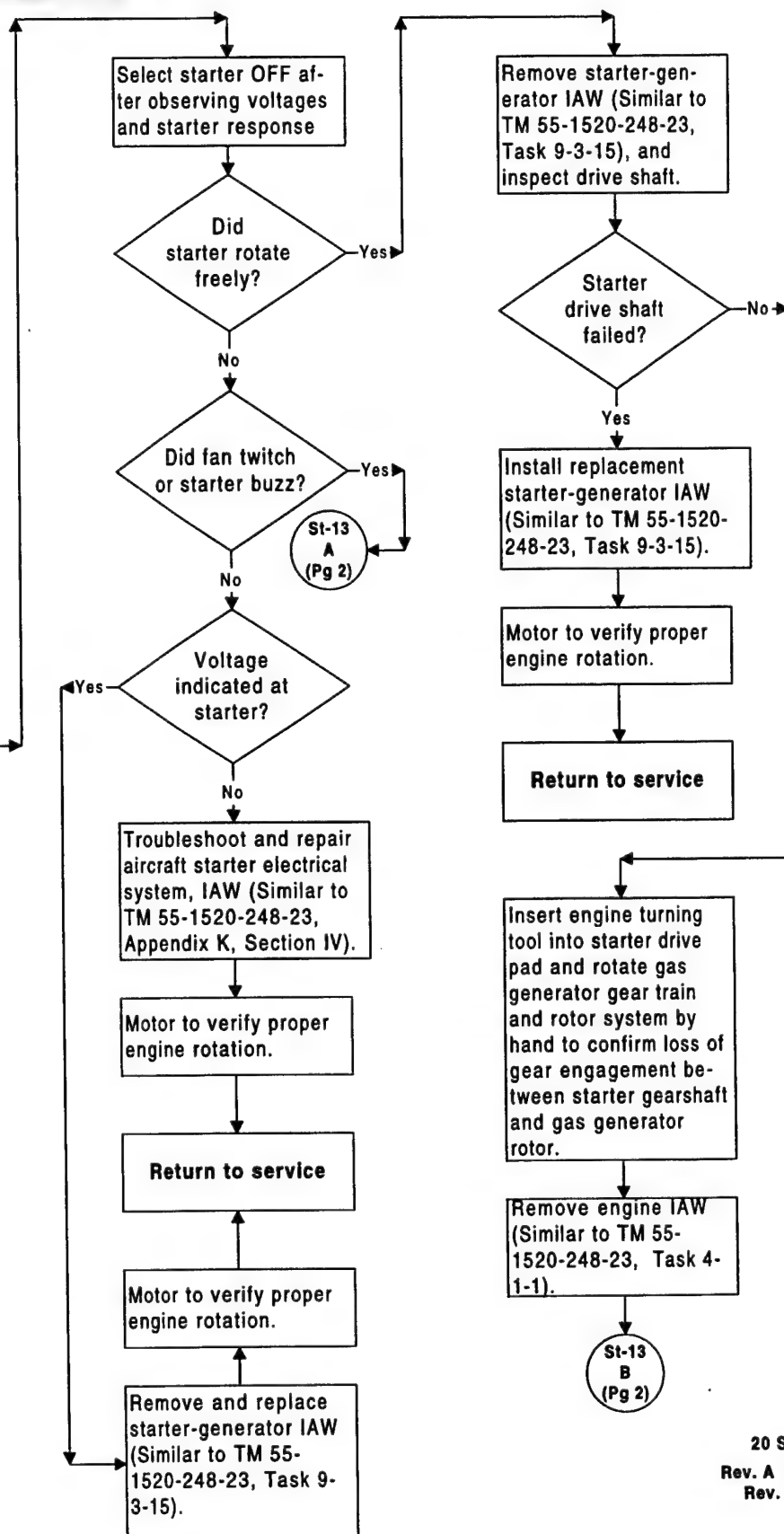
# St-13. Starter Will Not Rotate Engine

Failure of the engine to rotate when the starter is selected ON electrically can be caused by the following situations or conditions:

- Starter failed electrically
- Starter failed mechanically
- No electrical power to starter
- Gas generator rotor mechanically dragging or seized
- Gas generator rotor frozen by ice
- Accessory gearbox internal failed

If engine does not rotate when the starter in selected ON, proceed as follows to resolve the problem:

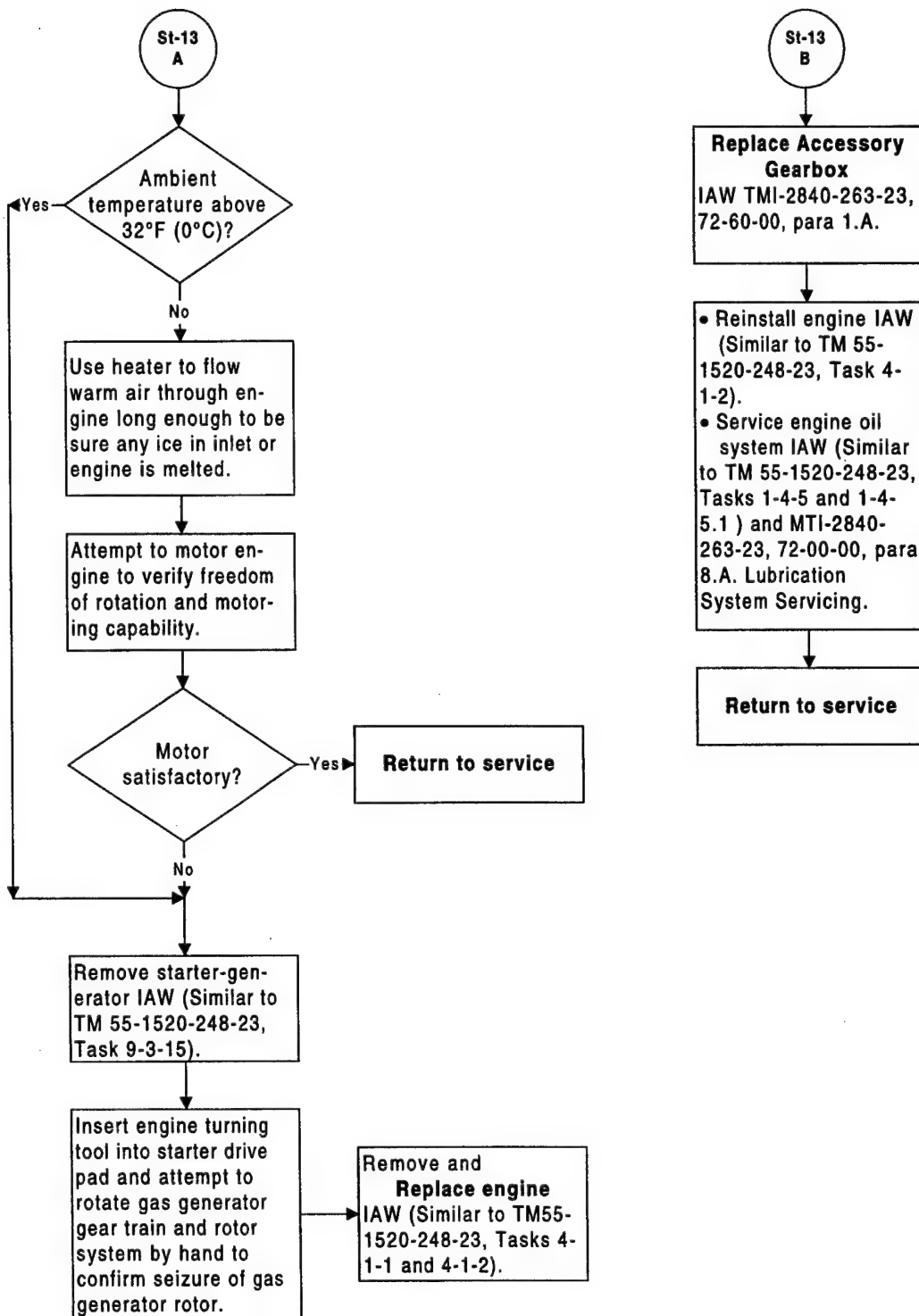
- Power up aircraft electrical system IAW (Similar to TM 55-1520-248-23, Task 9-3-10).
- On Multi-Parameter Display (MPD) unit, select BATT V - START V, to allow monitoring of battery and starter voltages.
- Pull IGN circuit breaker on forward overhead console panel and set twist grip to cutoff position.
- Engage starter switch.
- Note battery voltage prior to starter engagement and starter voltage with starter switch ON.
- Observe starter, particularly the starter cooling fan, for motion or other response as the starter switch is turned ON.



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## St-13. Starter Will Not Rotate Engine

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# R-1. Anti-icing System Operating Improperly

Several faults can affect anti-icing system function. Some leave the system ON at all times, some degrade its performance, others render it nonfunctional. These include:

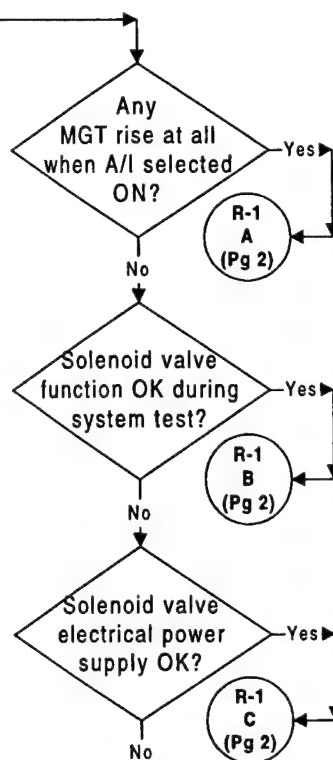
- Loss of electrical power to A/I solenoid valve (results in system ON)
- A/I air valve to solenoid valve tube loose/broken (results in system ON)
- A/I air valve to front support tube loose/broken (results in reduced or no icing protection of engine inlet)
- Dirt obstructing vents at trailing edge of inlet guide vanes (results in reduced icing protection of inlet guide vanes)
- A/I solenoid valve vent port plugged or obstructed (results in system OFF)
- A/I air valve stuck closed (results in system OFF)

If anti-icing system function is in question, proceed as follows to verify and correct if required:

Test anti-icing system IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B.  
This test verifies proper system function, proper function of the A/I solenoid valve, and identifies electrical power problems.

Did A/I ON increase MGT 5° to 15°C?

Return to service



14-28 volts DC measured?

Yes

No

Troubleshoot and repair related aircraft electrical circuitry IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).

Retest anti-icing system IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B.

Upon satisfactory completion

Return to service

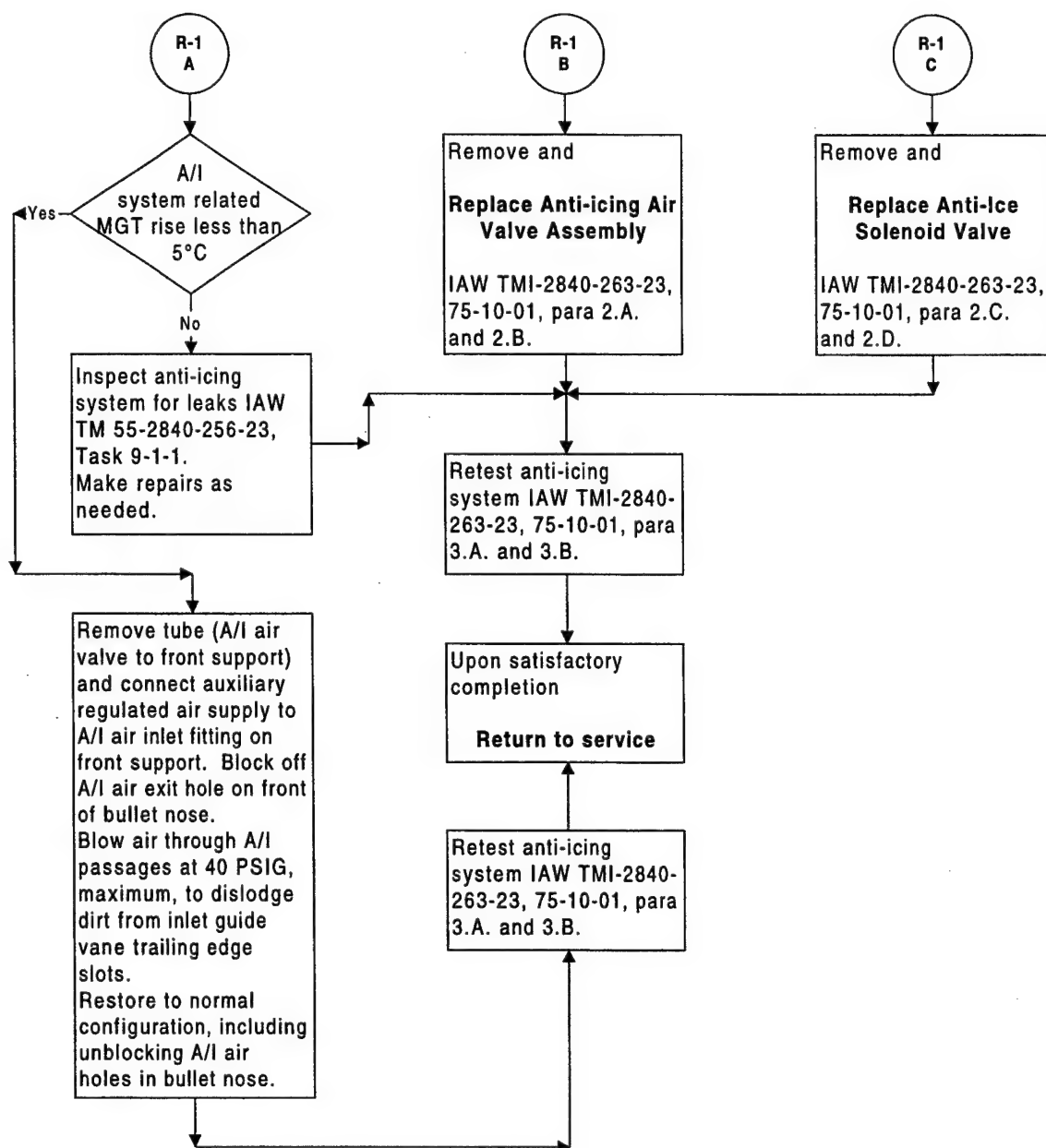
Retest anti-icing system IAW TMI-2840-263-23, 75-10-01, para 3.A. and 3.B.

Troubleshoot engine accessory harness to correct continuity problem between interface connector J16, pin U, and A/I solenoid valve connector P13, pin 1, and between J16, pin T, and P13, pin 2. If necessary, remove, test, and reinstall or replace accessory harness IAW.

TMI-2840-263-23, para 3.A., 3.B.

# R-1. Anti-icing System Not Operating Properly

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## R-2. Compressor Surge/Stall

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Compressor surge/stall during Ng accelerations may result from any of the following:

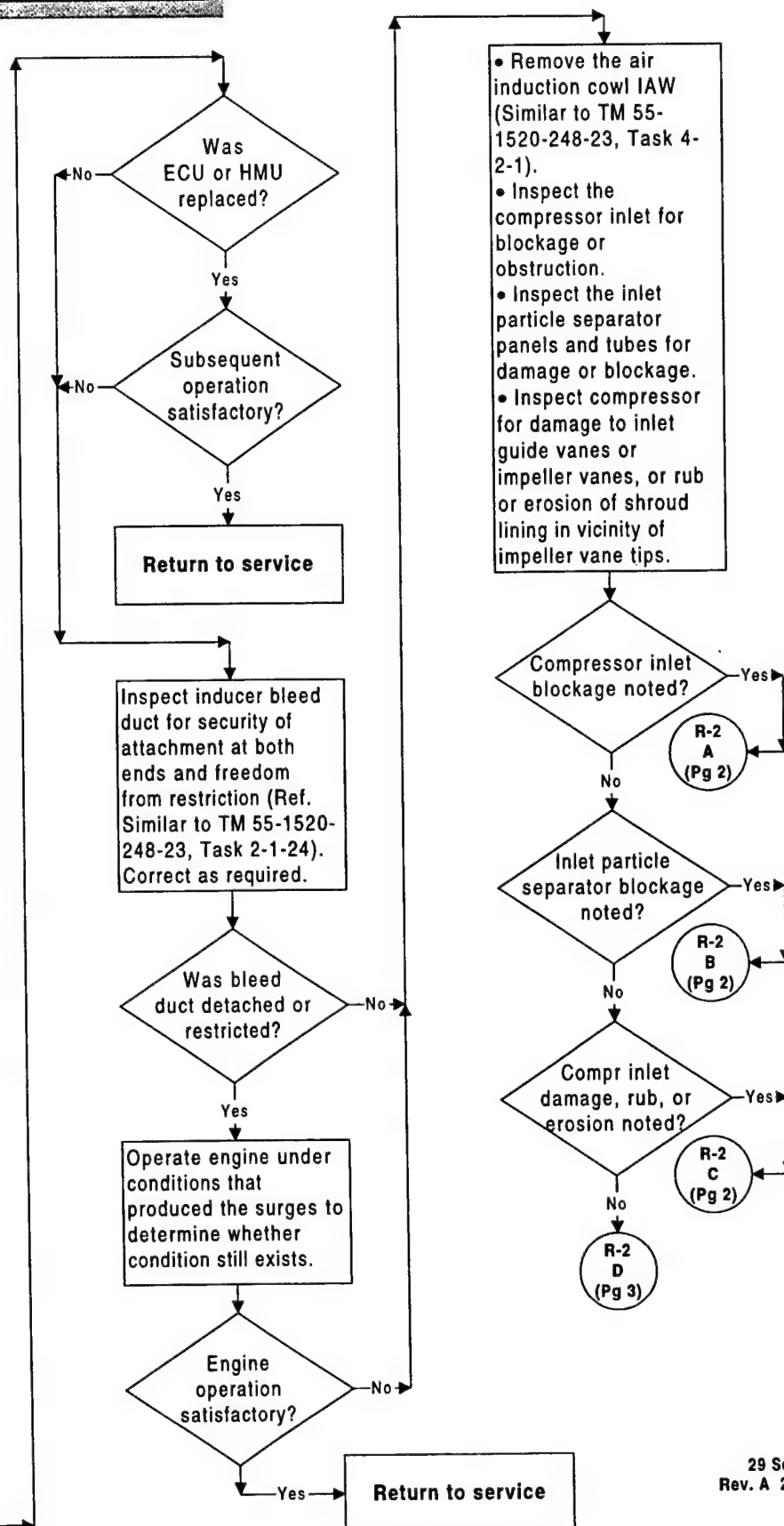
- ECU
- HMU
- Compressor inlet blockage
- Compressor inlet air temperature or pressure distortion
- Inducer bleed restriction or disconnection
- Compressor inlet or diffuser damage, rub, or erosion

If surges are suspected, connect Maintenance Terminal and check

**Maintenance History, Pg 2 of 2**, for Surge Counter (SgCtr) reading to verify. The counter increases its indication by 1 each time a surge is sensed by the FADEC. Also read Maintenance Terminal for fault indications, and correct as required to clear.

Insofar as possible, conduct subsequent engine diagnostic running with aircraft headed into wind to rule out exhaust gas ingestion as a cause of the surges.

If ECU or HMU were replaced as a result of clearing faults, operate the engine under conditions that produced the surges to determine whether condition still exists:

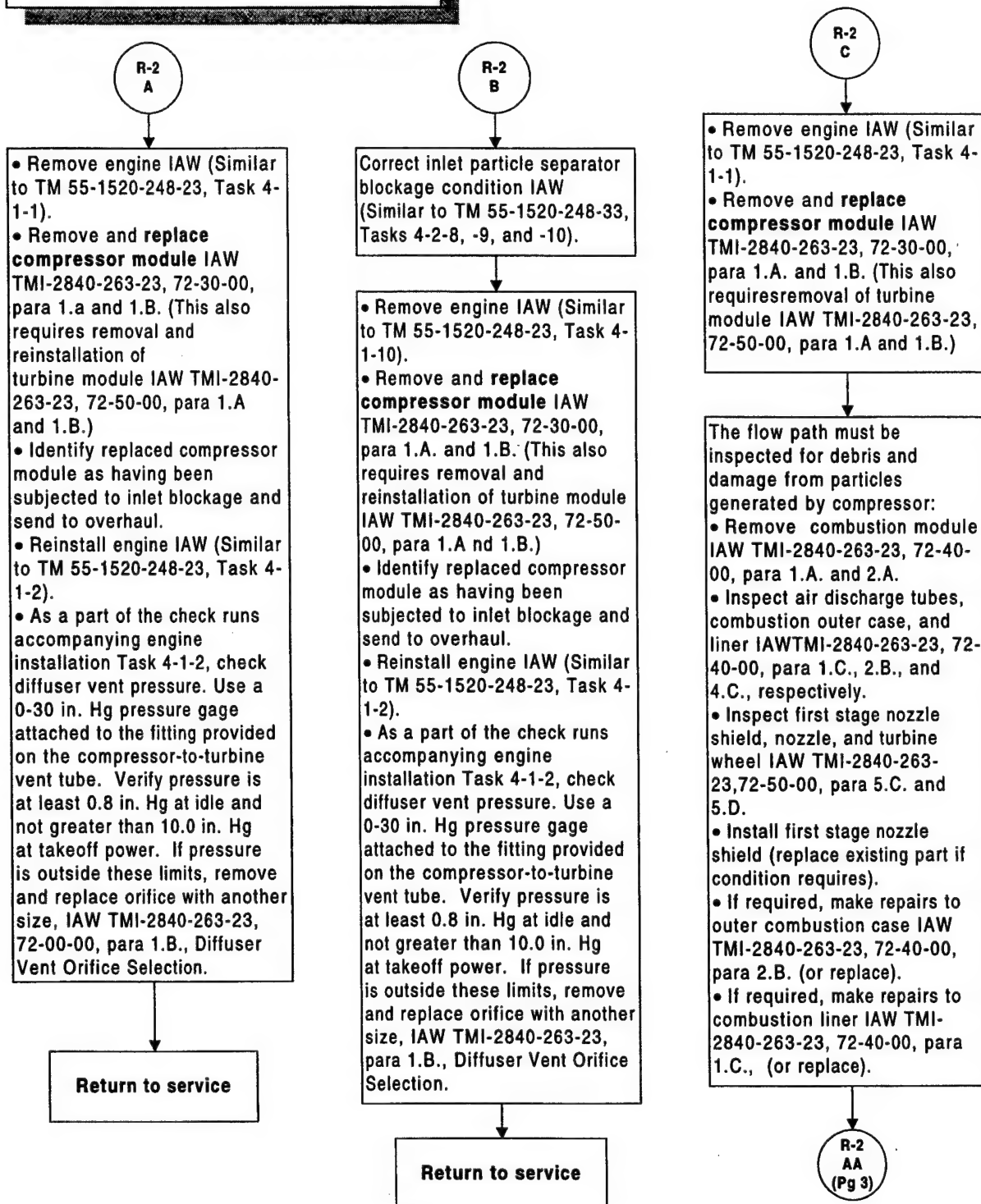


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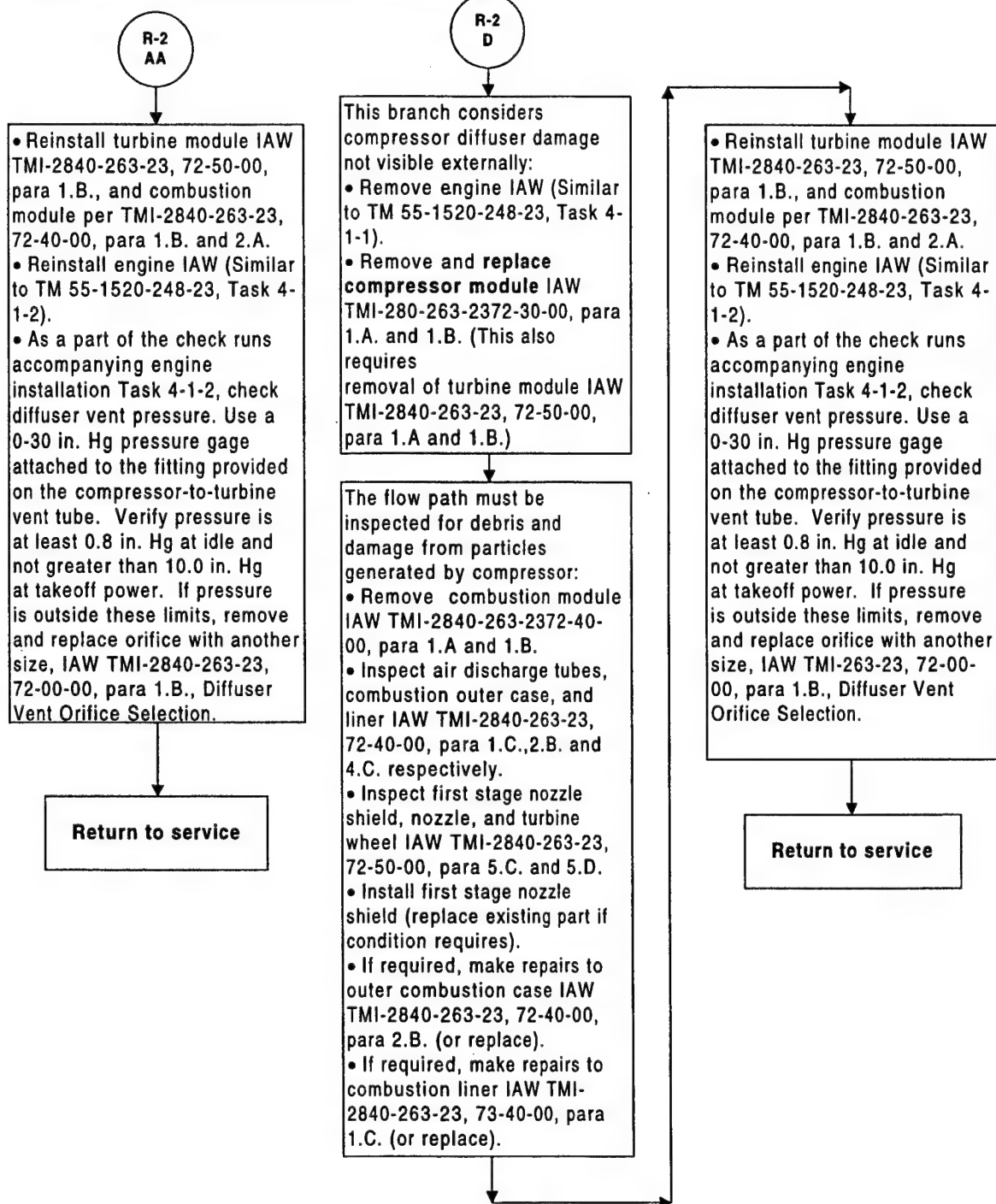
## R-2. Compressor Surge/Stall

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## R-2. Compressor Surge/Stall

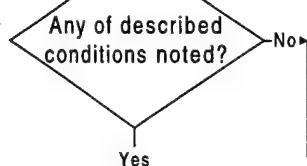


Sparks in the engine exhaust during engine operation can be caused by several different conditions, such as:

- Compressor rubbing from bearing failure, or from ingestion damage
- Damage to the turbine section from localized hot spot, rubbing, ingestion damage or other causes
- Carbon building and shedding in the combustor as a result of a faulty fuel nozzle spray pattern, or of combustor damage
- Molten metal from combustion liner as a result of faulty fuel nozzle spray pattern or inadequate surface cooling due to local damage.

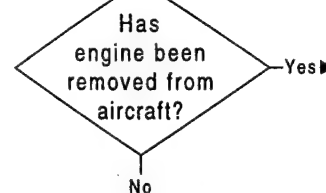
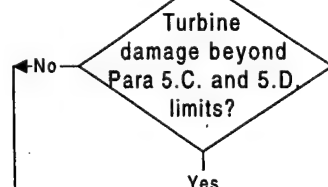
If sparks are being emitted from the engine exhaust, proceed in the following sequence to identify the cause and correct the problem:

- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect compressor for damage to inlet guide vanes or impeller vanes, or rub of shroud lining in vicinity of impeller vane tips.
- Inspect compressor rotor for radial looseness at No. 1 bearing location.



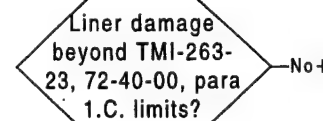
- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace compressor module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B. (This also requires removal of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.)

- Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
- Inspect air discharge tubes, combustion outer case, and liner IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D., respectively.
- Inspect first stage nozzle shield, nozzle, and turbine wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D.



Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).

Remove and replace turbine module IAW TMI-2840-263-23, 72-50-00, 1.A. and 1.B.

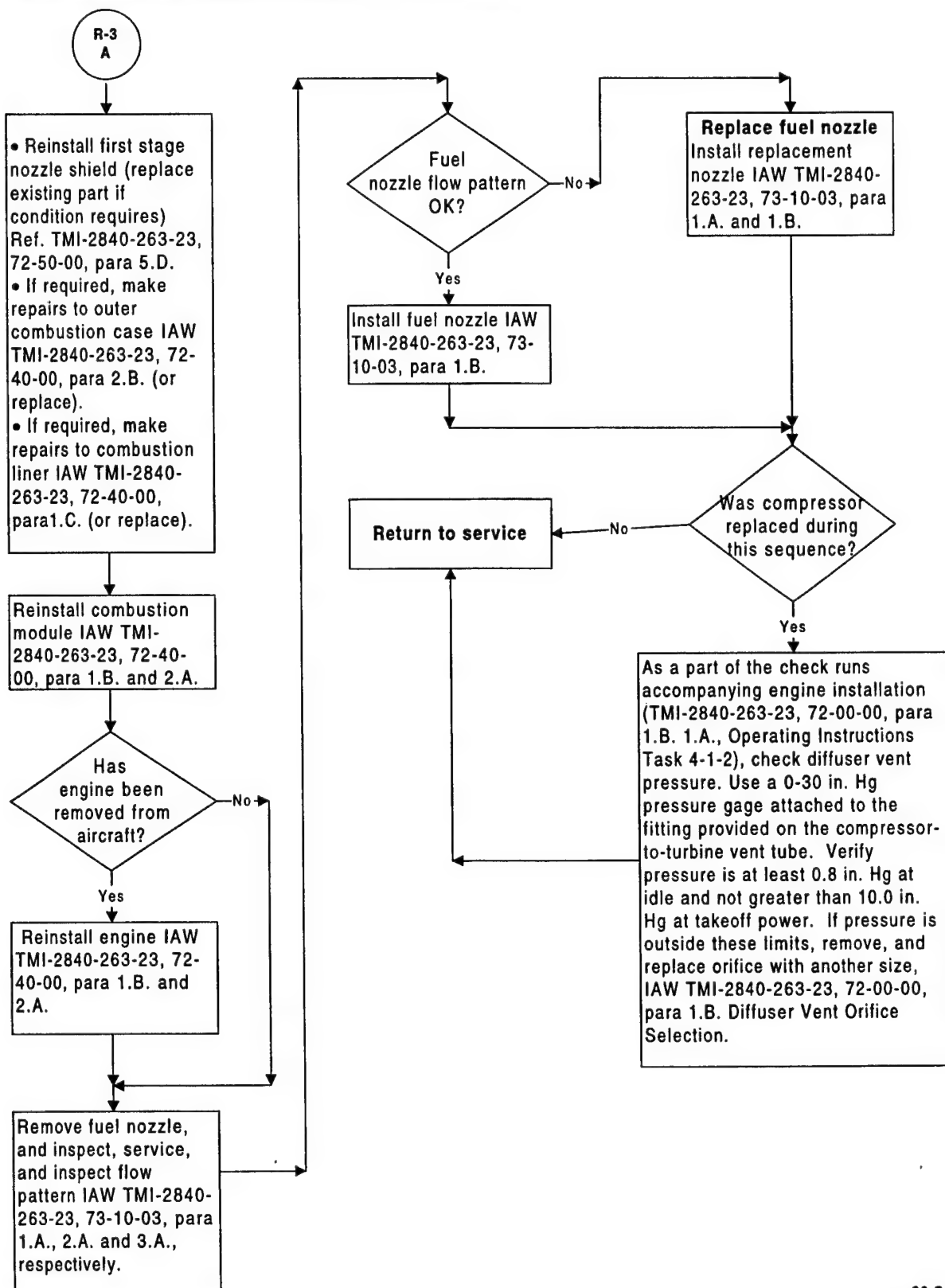


Replace combustion liner

R-3  
A  
(Pg 2)

## R-3. Exhaust Duct Emitting Sparks

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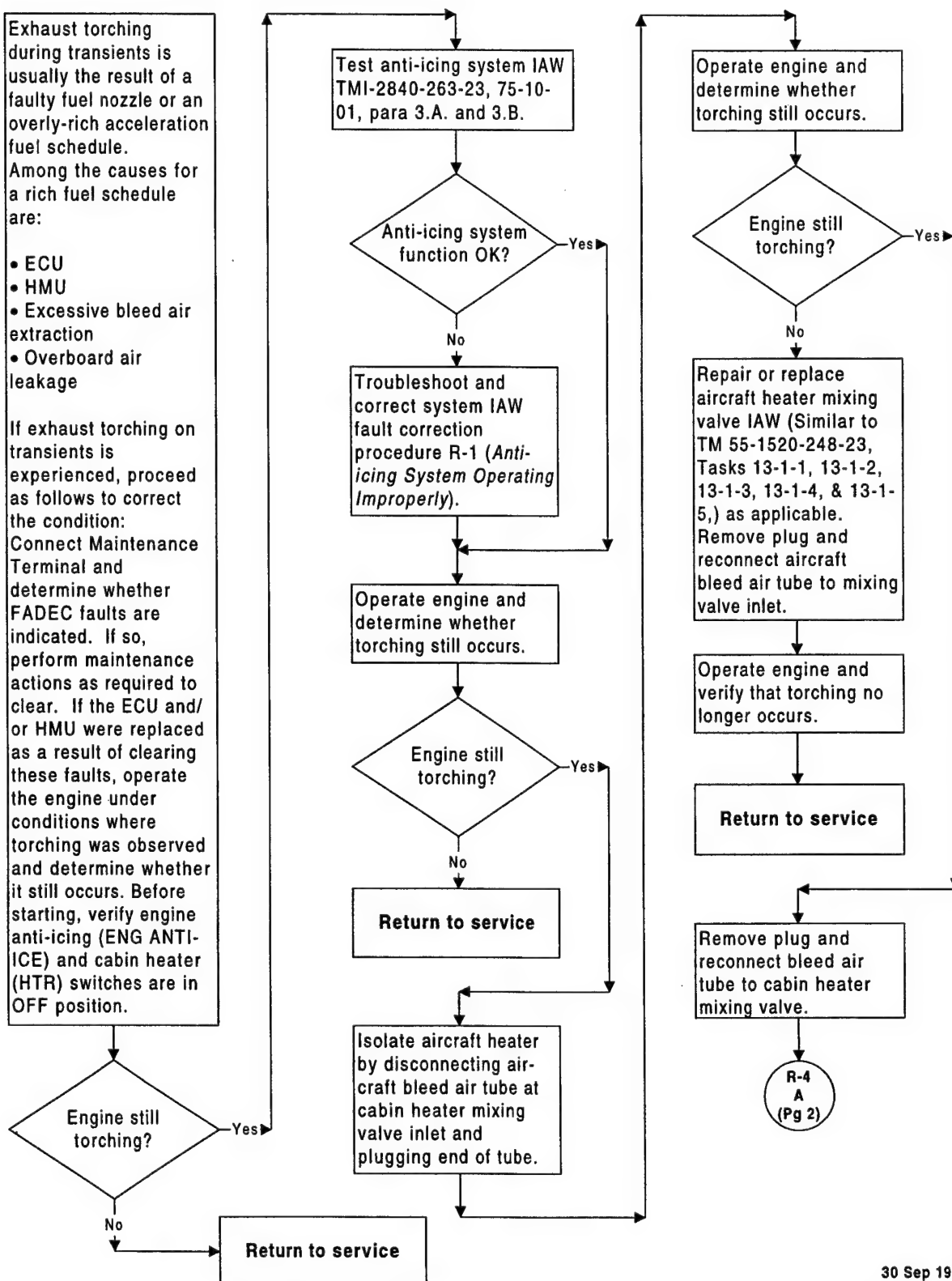
## R-4. Exhaust Torching During Transients

Page 1 of 3

Exhaust torching during transients is usually the result of a faulty fuel nozzle or an overly-rich acceleration fuel schedule. Among the causes for a rich fuel schedule are:

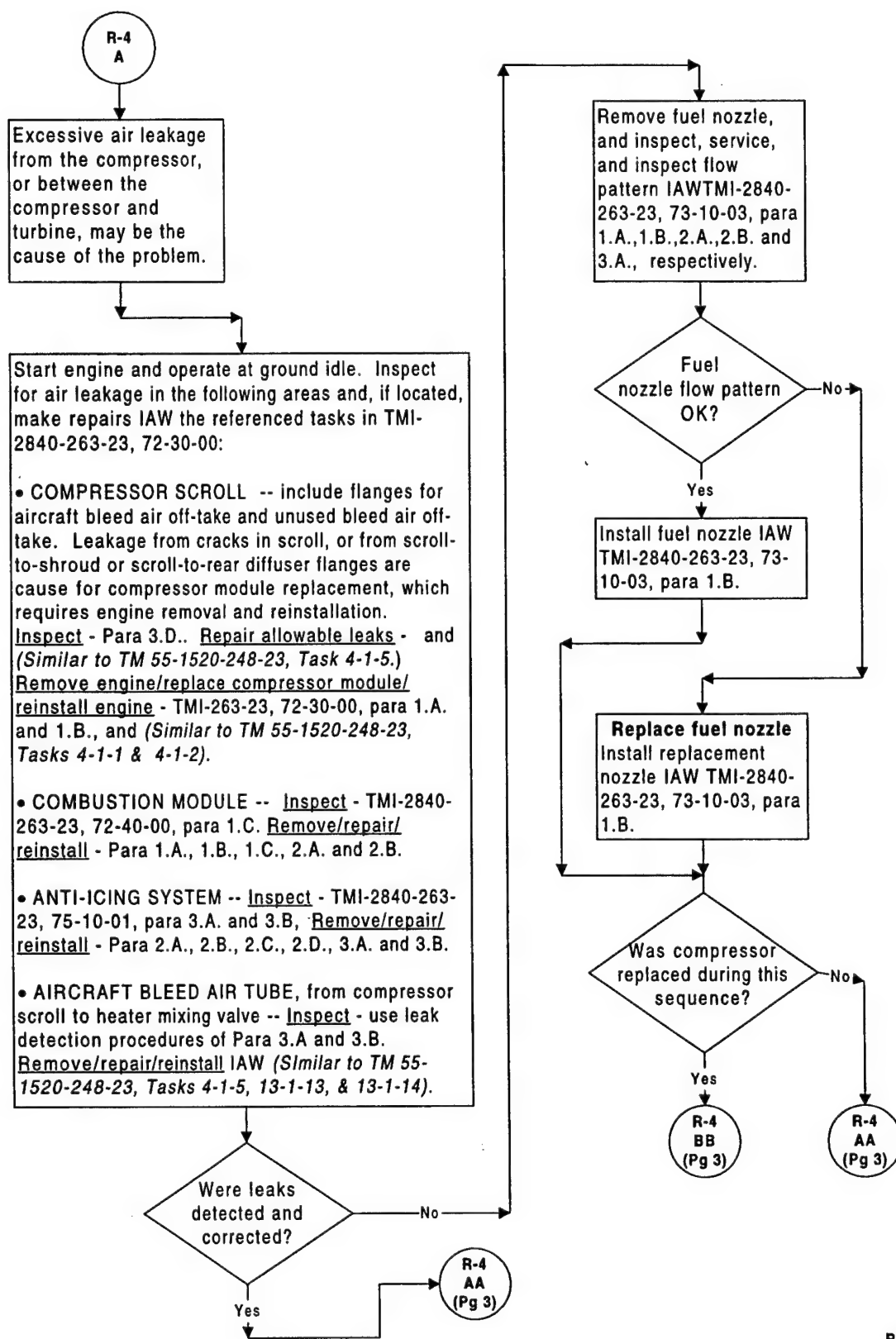
- ECU
- HMU
- Excessive bleed air extraction
- Overboard air leakage

If exhaust torching on transients is experienced, proceed as follows to correct the condition: Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, operate the engine under conditions where torching was observed and determine whether it still occurs. Before starting, verify engine anti-icing (ENG ANTI-ICE) and cabin heater (HTR) switches are in OFF position.



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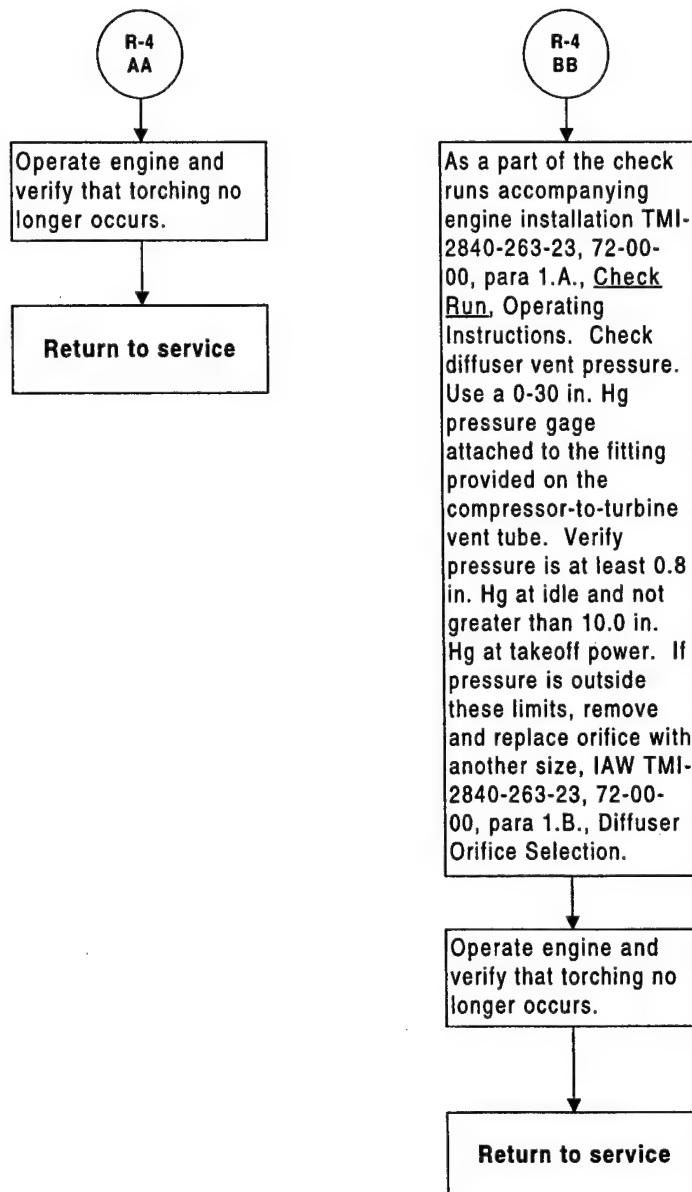
## R-4. Exhaust Torching During Transients



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## R-4. Exhaust Torching During Transients

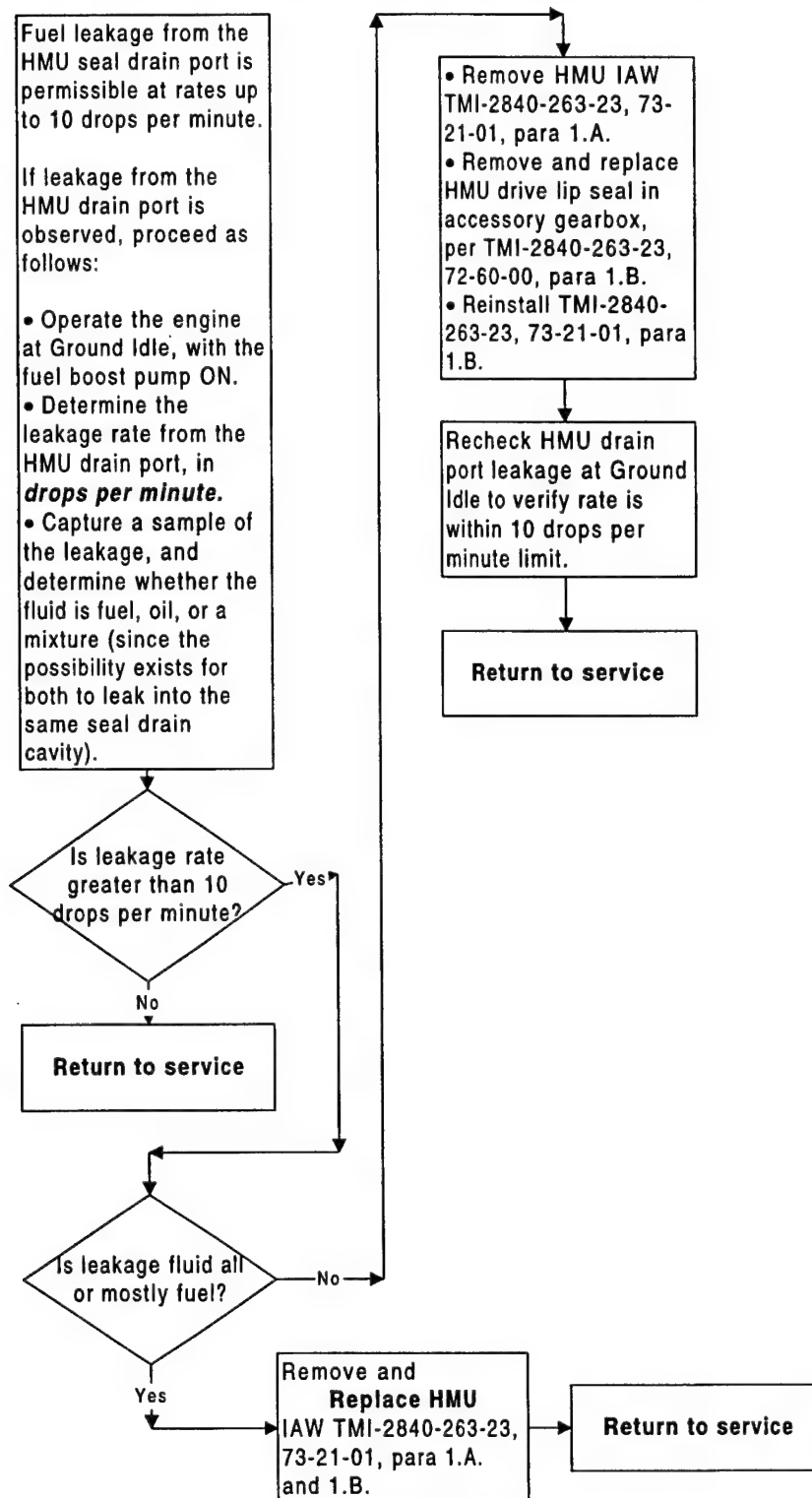
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## R-5. Fuel Leaking From HMU Overboard Drain Port

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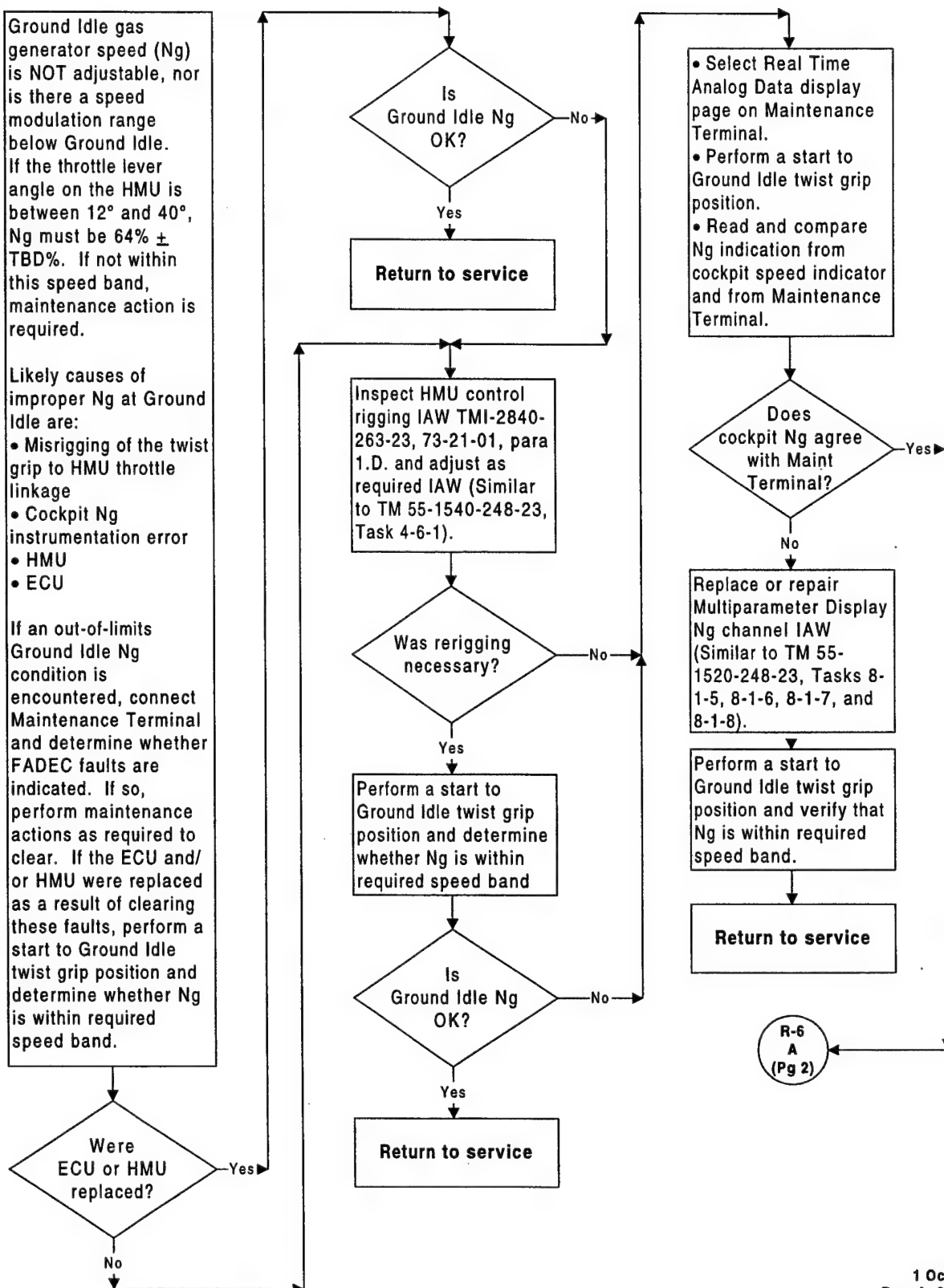
## R-6. Ground Idle Speed Too High Or Too Low

Ground Idle gas generator speed (Ng) is NOT adjustable, nor is there a speed modulation range below Ground Idle. If the throttle lever angle on the HMU is between 12° and 40°, Ng must be 64%  $\pm$  TBD%. If not within this speed band, maintenance action is required.

Likely causes of improper Ng at Ground Idle are:

- Misrigging of the twist grip to HMU throttle linkage
- Cockpit Ng instrumentation error
- HMU
- ECU

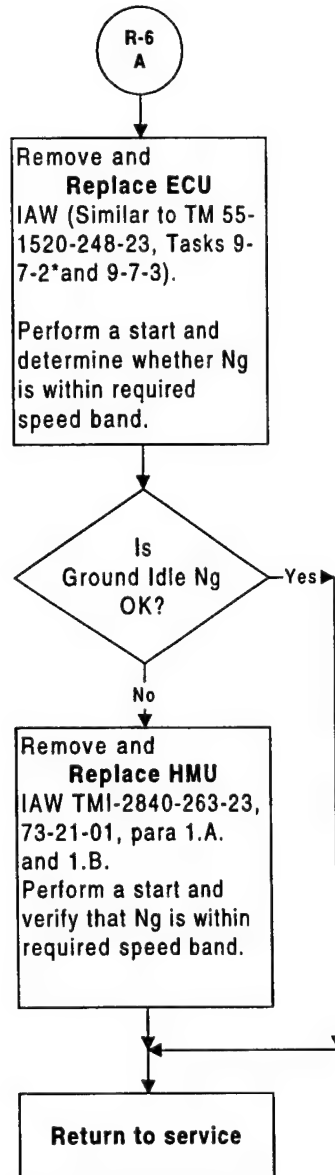
If an out-of-limits Ground Idle Ng condition is encountered, connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the ECU and/or HMU were replaced as a result of clearing these faults, perform a start to Ground Idle twist grip position and determine whether Ng is within required speed band.



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## R-6. Ground Idle Speed Too High Or Too Low

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The engine is fitted with two magnetic chip detectors, **upper** and **lower**. Oil scavenged from the accessory gearbox, which includes all accessory gears and bearings, plus the following main bearings, flows past the **lower** chip detector.

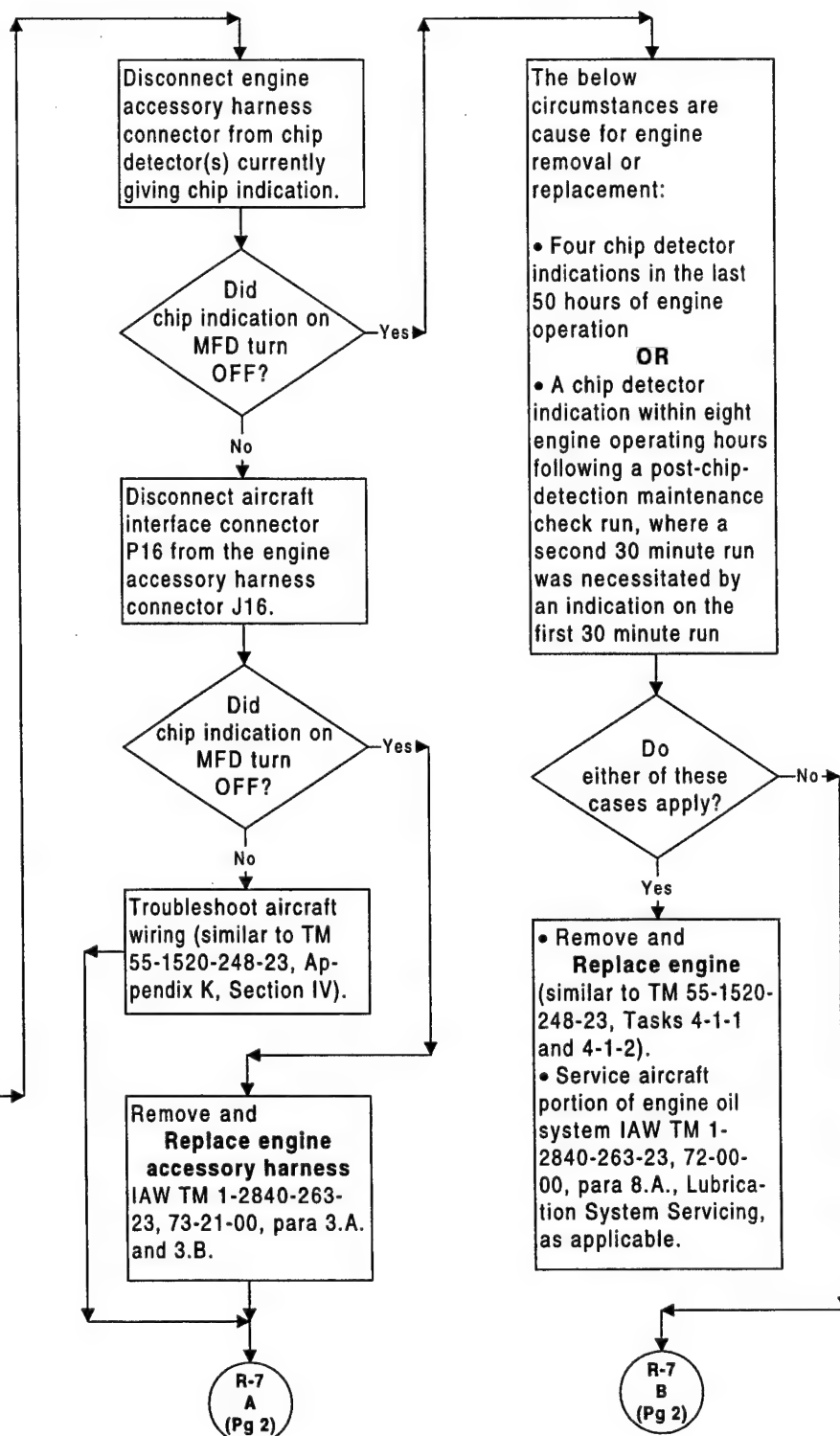
- No. 2 (rear compressor)
- No. 2½ (spur adapter gearshaft)
- Nos. 3 and 4 (power train pinion gear)
- No. 5 (front power turbine)

Oil flowing past the **upper** chip detector comprises **all** oil scavenged from the engine, including the oil that has already flowed past the **lower** chip detector plus oil from the following main bearings:

- No. 1 (front compressor)
- No. 6 (rear power turbine)
- No. 7 (front GG turbine)
- No. 8 (rear GG turbine)

The non-fuzz-burning chip detectors are connected through the engine accessory harness to an aircraft harness, which transmits chip indications to the Multifunction Display (MFD).

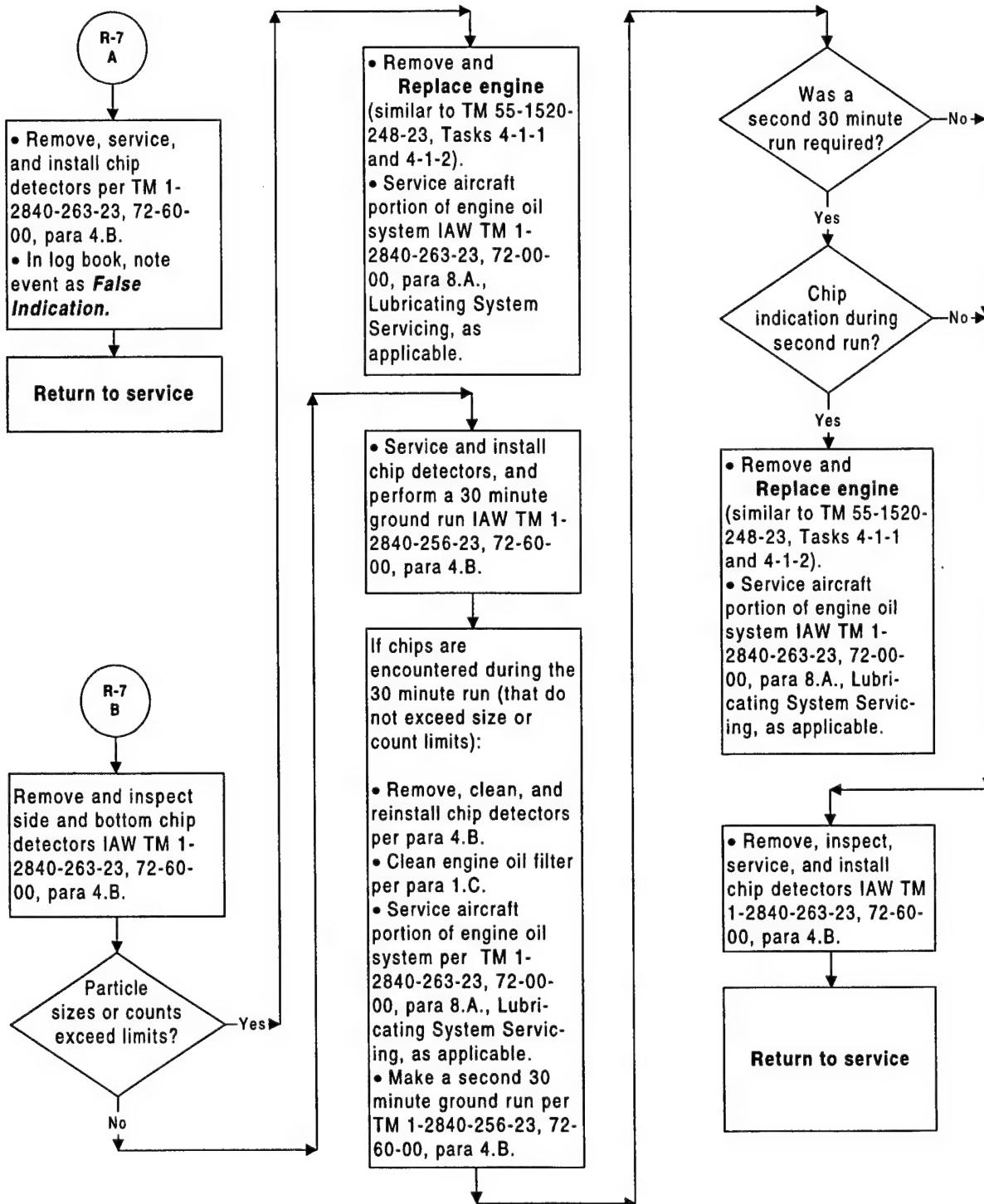
The following sequence presents actions to be taken if engine chip detector **CAUTIONS** are displayed on the MFD.



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## R-7. Magnetic Chip Detector Warning

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Abnormally low measured MGT with other engine parameters (such as Ng and torque) being in the normal range is usually caused by such items as:

- Aircraft MGT indicator
- Engine thermocouple harness
- Engine electrical harness
- Engine accessory harness

If an abnormally low MGT condition is encountered, proceed as follows to correct:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If the MGT harness, the engine electrical harness, or the engine accessory harness were replaced as a result of clearing these faults, make an engine run to determine whether MGT now appears normal.

MGT or other engine harnesses replaced?

No

Yes

MGT indication satisfactory?

No

Yes

Field-check the calibration of the cockpit MGT indicator as follows:

- Remove the two nuts from the MGT harness terminal block studs and lift off MGT harness leads and engine electrical harness leads (but leave signal leads from engine accessory harness attached to the studs).
- Using Thermocouple Calibrator (OMEGA Model CL-300-1000C-K [TBD] or equivalent), attach the chromel lead of the calibrator to the chromel terminal stud and the alumel calibrator lead to the alumel terminal block stud.
- Reinstall the stud nuts, and torque to 18-24 in.-lb.
- Power up the aircraft with battery or APU.
- Set thermocouple calibrator to 800°C (1472°F) and observe and record MGT value displayed on the cockpit MGT indicator.
- Repeat above steps at calibrator settings of 700°C (1292°F) and 600°C (1112°F).
- MGT indications from cockpit digital MGT indicator should agree with the thermocouple calibrator within  $\pm$  TBD °C ( $\pm$  TBD °F).

Return to service

Cockpit MGT indicator agrees with calibrator?

No

Yes

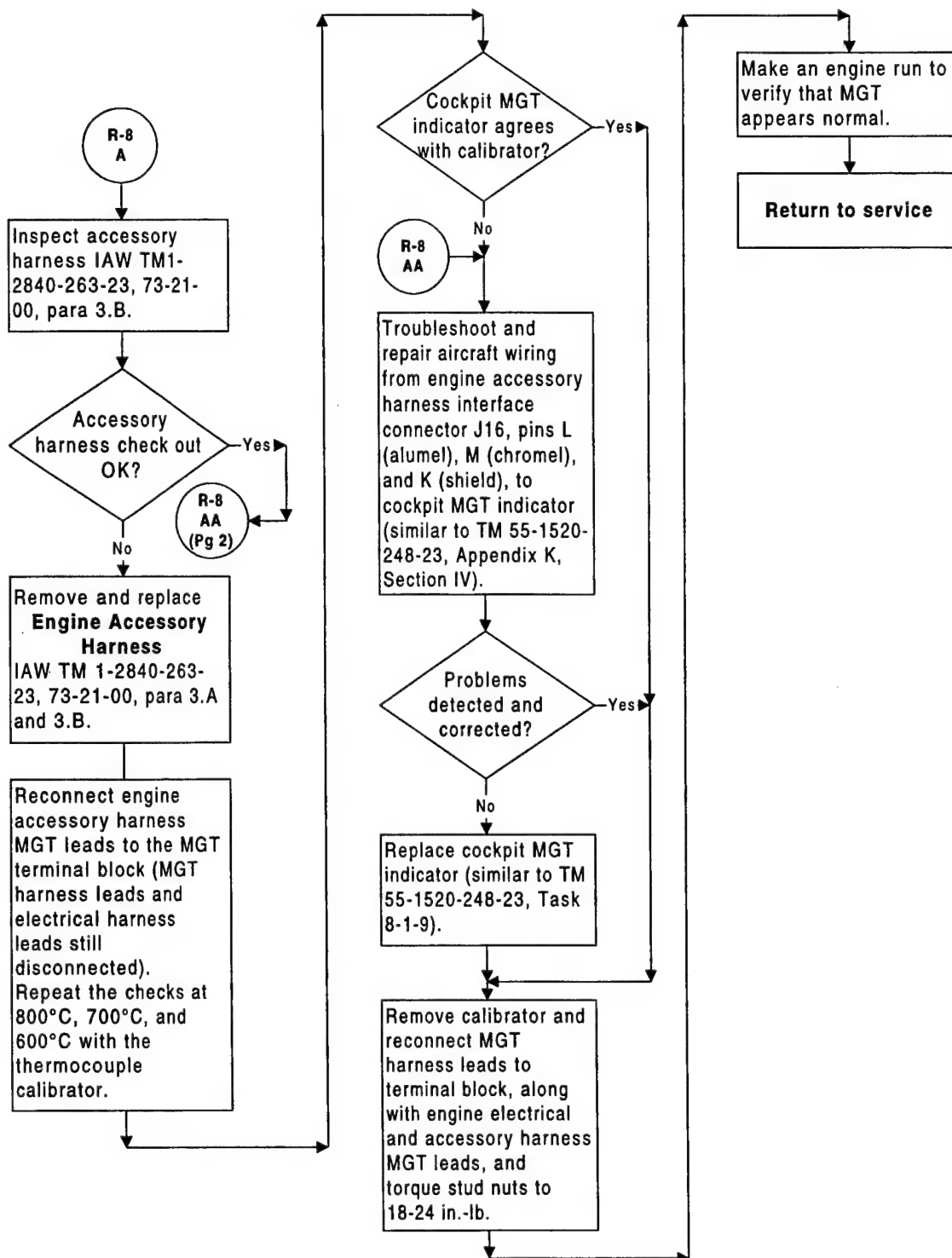
Remove and replace **Engine Thermocouple Harness** IAW TM 1-2840-263-23, 77-20-01, para 1.A. and 1.B.

Remove calibrator and reconnect MGT harness leads to terminal block, along with engine electrical and accessory harness MGT leads, and torque stud nuts to 18-24 in.-lb.

Make an engine run to verify that MGT appears normal.

Return to service

R-8  
A  
(Pg 2)



Allowable operating limits for gas generator speed (Ng) and power turbine speed (Np), and maintenance actions required upon limits exceedences, are as follows:

## GAS GENERATOR SPEED (Ng)

- Above 106% or
- 105%-106% over 10 seconds

### Repair/overhaul compressor and turbine

## POWER TURBINE SPEED (Np)

- Above 119% (or maximum indication of Np speed indicator), or
- Any time complete loss of output shaft load occurs, or
- Any time maximum allowable Np (adjusted for torque) is exceeded, or
- Any time continuous allowable Np (adjusted for torque) is exceeded for more than 15 seconds

### Repair/overhaul turbine and gearbox

It is possible, particularly during extreme transient maneuvers, during operation in the FADEC manual mode, or in an event such as an output shaft failure, to exceed these limits.

The ECU captures overspeed events in its memory, the magnitude of which can be accessed with the Maintenance Terminal.

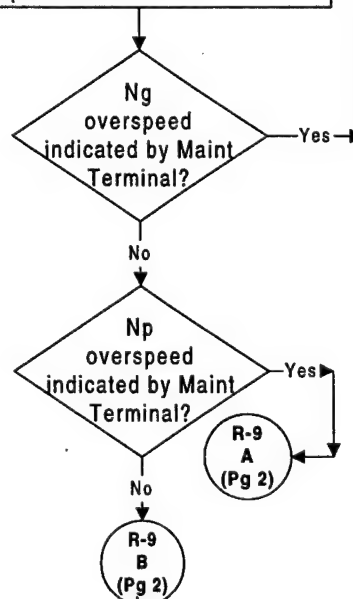
If Ng or Np overspeeds occurred or are suspected, proceed as follows to resolve:

Connect the Maintenance Terminal and select the Maintenance History display. Read out the values of the following parameters:

**NgLmPk** -- the highest Ng reached, if above 106%  
**NgLmTm** -- the time (sec.) above 106% Ng  
**NgRLmPk** -- the highest Ng reached, if above 105%  
**NgRLmTm** -- the time (sec.) greater than 10 seconds that Ng exceeded 105%  
**NpQNppkExLm** -- the highest Np reached if above maximum allowable Np (adjusted for torque)  
**NpQNppkRnLm** -- the highest Np reached above the continuous allowable Np (adjusted for torque) limit if exceeded for more than 15 seconds

If **NgLmPk** is greater than 106%, or if **NgRLmTm** is greater than 0.000 seconds, a gas generator overspeed has occurred.

If **NpQNppkExLm** or **NpQNppkRnLm** show values above 107% Np, a power turbine overspeed has occurred.

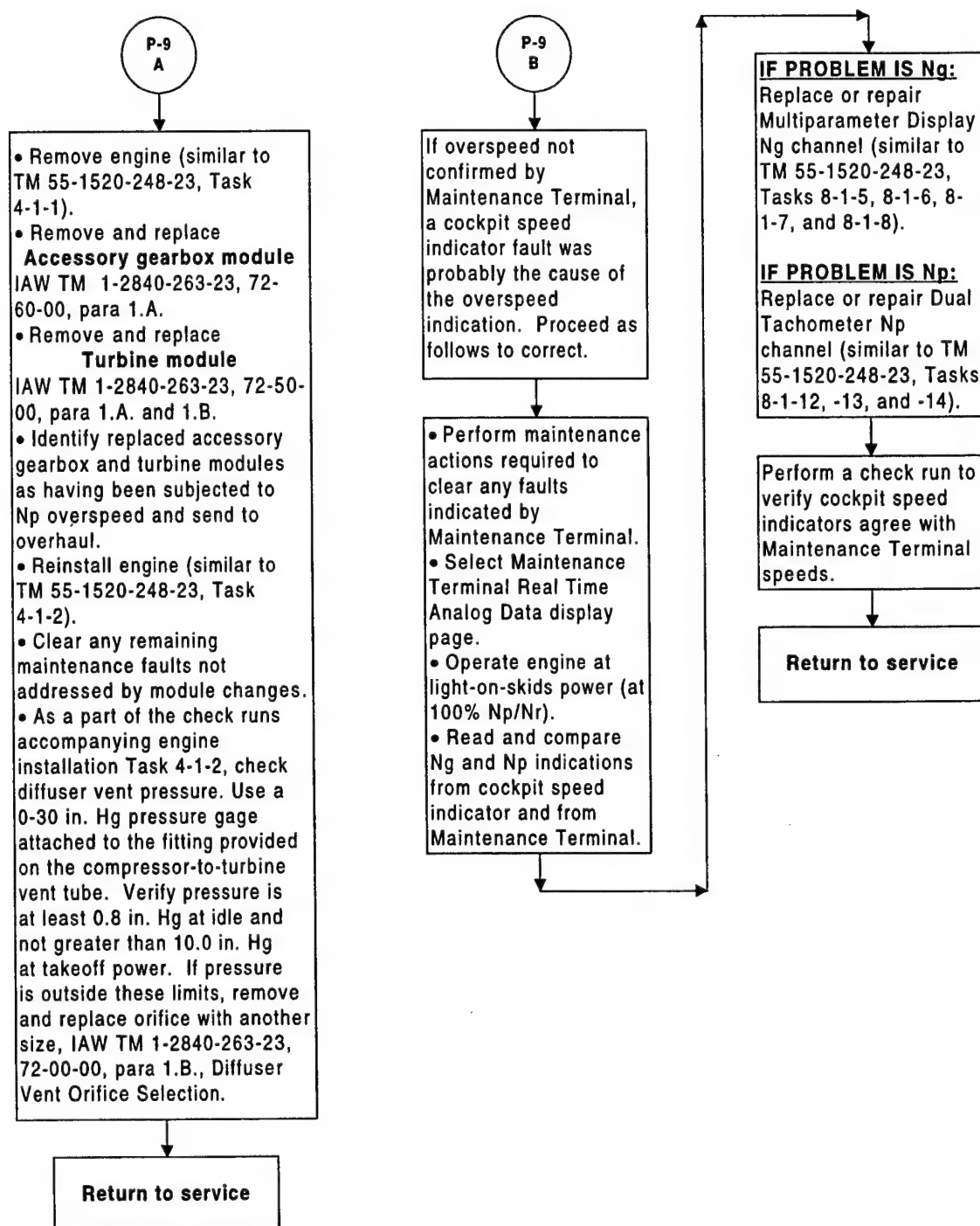


- Remove engine (similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace **Compressor module** IAW TM 1-2840-263-23, 72-30-00, para 1.A. and 1.B.
- Remove and replace **Turbine module** IAW TM 1-2840-263-23, 72-50-00, para 1.A and 1.B.
- Identify replaced compressor and turbine modules as having been subjected to Ng overspeed and send to overhaul.
- Reinstall engine (similar to TM 55-1520-248-23, Task 4-1-2).
- Clear any remaining maintenance faults not addressed by module changes.
- As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TM 1-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service

## R-9. Ng Or Np Overspeed

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## R-10. Ng Or Np Speed Not Indicating

Engine rotor speed signals (Ng and Np) are each generated by dual channel sensors located in the engine accessory gearbox. Either channel can supply the control system requirements, and logic within the FADEC allows it to detect and reject a faulty channel, and switch to the other, without functional impairment.

The engine speed indicators in the cockpit share channel No. 2 on each speed sensor with the FADEC. If sensor channel No. 2 fails, there is no capability to use the alternate channel -- the result being loss of cockpit engine speed indication for the engine rotor system involved.

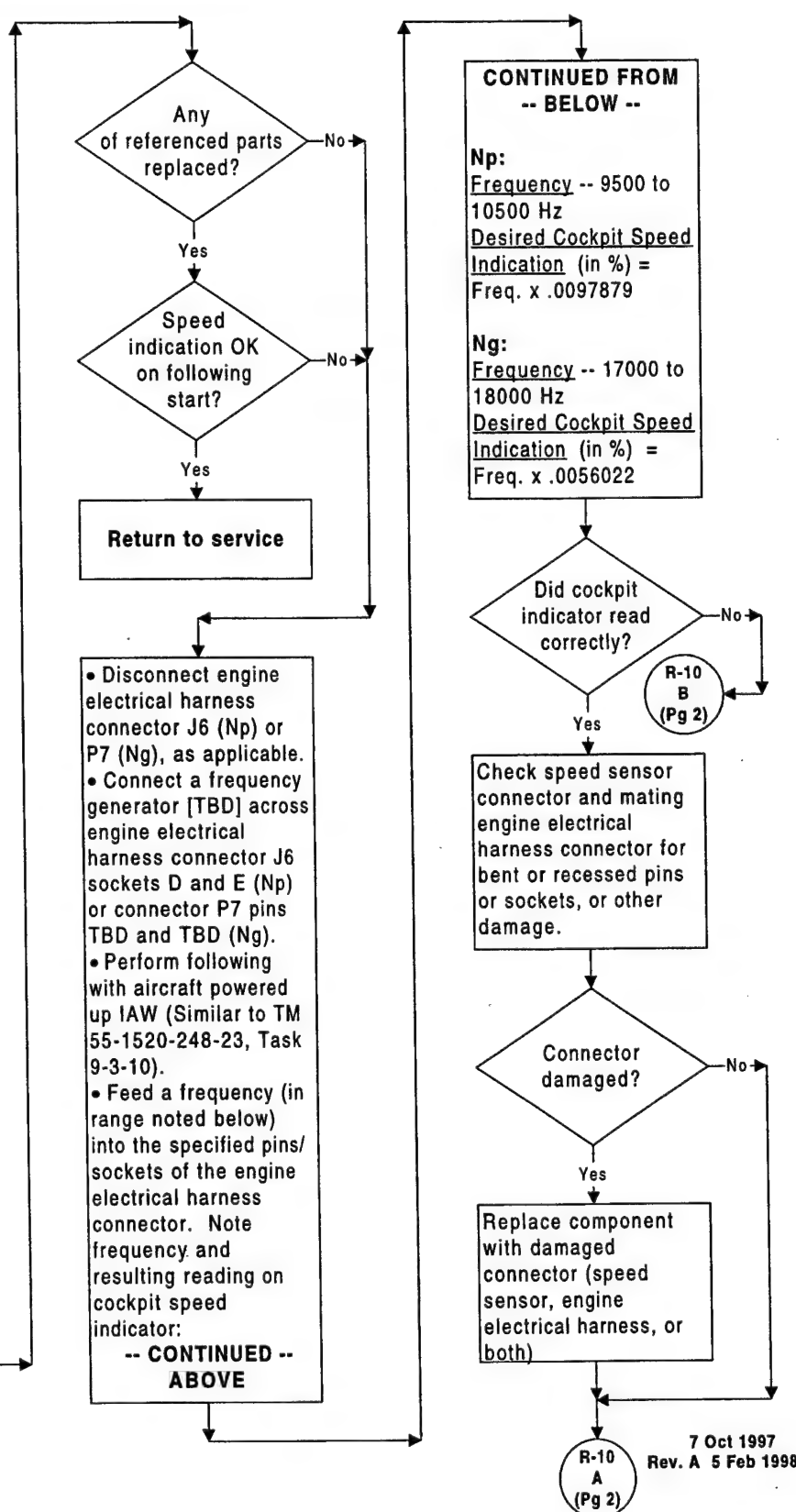
If cockpit speed indication is lost or erratic as a result of sensor failure, it will result in an Ng or Np fault indication on the Maintenance Terminal. If the aircraft wiring or speed indicator is responsible, there will be no Maintenance Terminal fault indication.

To correct the problem, proceed as follows:

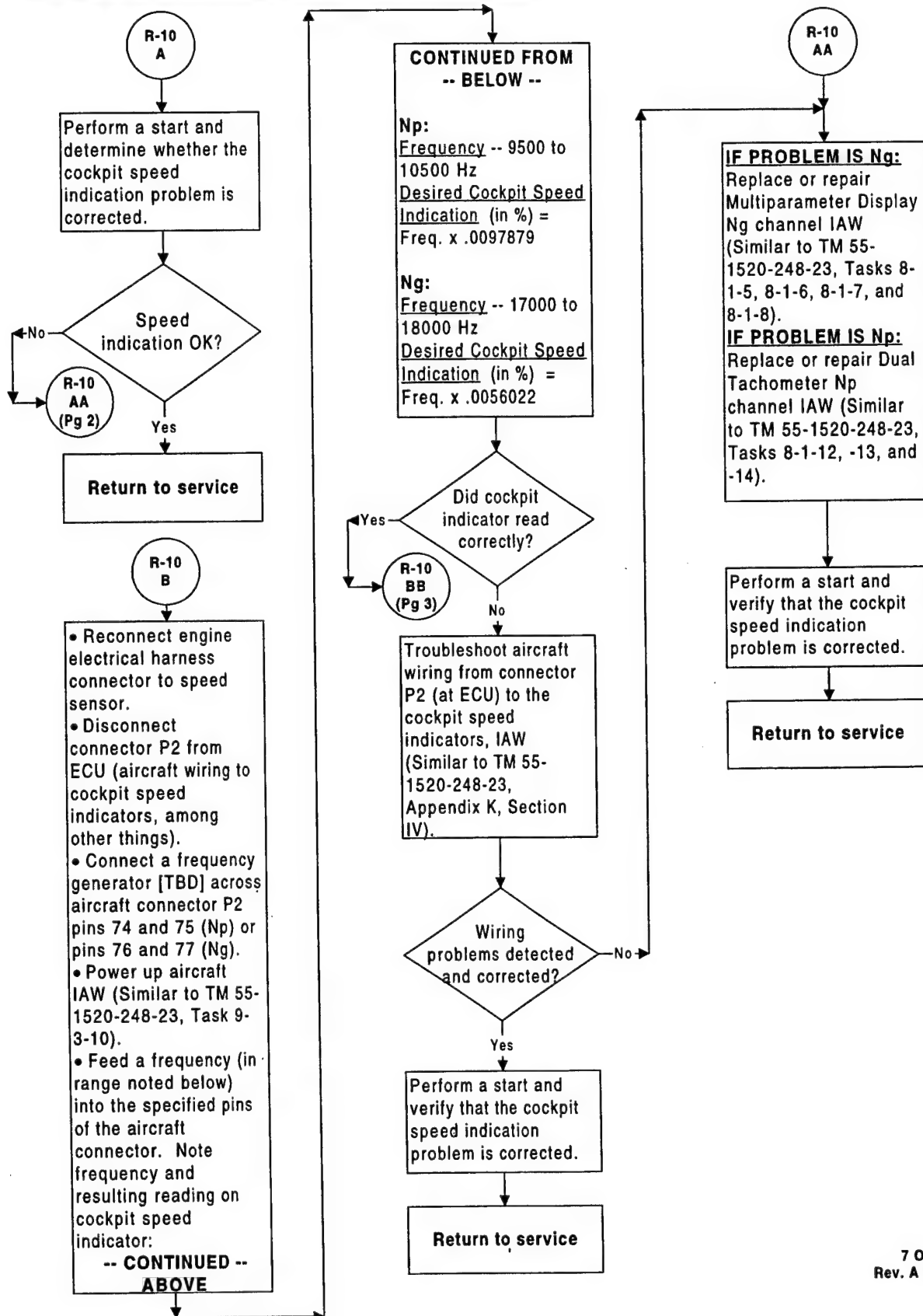
Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If, as the result of a fault indication(s), any of the following were replaced:

- ECU
- Engine Electrical Harness
- Speed Sensor on channel experiencing cockpit speed indication problem

perform a start and determine whether the cockpit speed indication problem still exists.

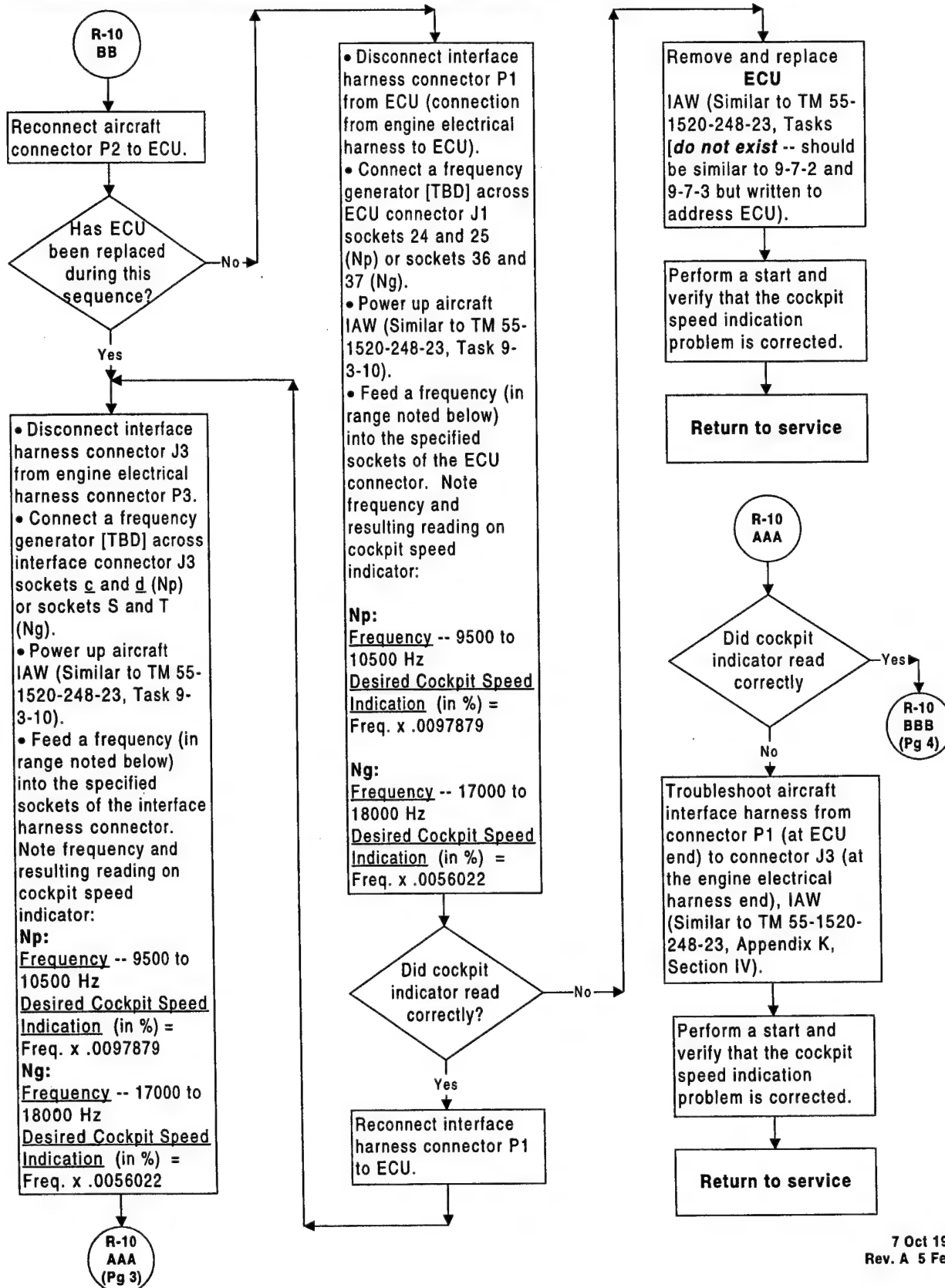


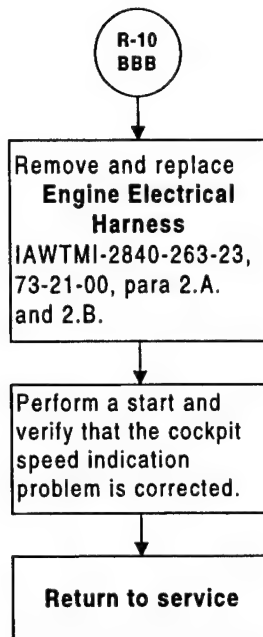
# R-10. Ng Or Np Speed Not Indicating



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### R-10. Ng Or Np Speed Not Indicating





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# R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)

Page 1 of 3

Engine oil consumption is normally quite low. An oil usage rate in excess of one quart in five hours is indicative of a problem and requires corrective action.

Primary sources of oil consumption are:

- **External**, from such places as lube system tubes and fittings, oil tank, oil cooler, scavenge oil filter, and accessory gearbox output shaft and accessory drive lip seals. External oil leaks can be detected visually and most can be repaired without engine removal.
- **Gas path**, from locations such as the front compressor carbon seal, the power turbine No. 5 labyrinth seal, or the accessory gearbox breather vent. These leaks are generally detectable from oil puddling or wetting of adjacent surfaces.
- **Internal**, into various internal cooling air or pressure balance cavities, resulting from labyrinth seal wear or rubbing, coking and blockage of oil scavenge passages, or degradation of oil scavenge pump capacity. These conditions, the most hazardous to engine health, can usually be detected by continuous smoking from the engine exhaust.

If oil consumption exceeds one quart in five hours, or has increased suddenly, visually inspect the engine, lube system, and drains.

External oil leakage or drainage noted?

Yes

Locate source(s) of leakage and correct as follows:

• **TUBE ENDS, HOSE ENDS, FITTINGS, ETC.** -- tighten as required

• **EXTERNAL LUBE SYSTEM COMPONENTS** --

repair or replace IAW (Similar to TM 55-1520-248-23:

**Oil tank** -- Tasks 4-4-1 through 4-4-8

**Oil cooler bypass valve** -- Task 4-4-9

**Oil scavenge filter** -- Task 4-4-18)

• **ENGINE ACCESSORY DRIVE LIP SEALS** -- replace

IAW TMI-2840-263-23, 72-60-00, para 1.B.

Associated accessory remove/reinstall tasks: **HMU** -- TMI-2840-263-23, 73-21-01, para 1.A. and 1.B.

**PMA** -- [no tasks written yet]

**STARTER-GENERATOR** -- (Similar to TM 55-1520-248-23, Task 9-3-15)

• **OUTPUT DRIVE LIP SEALS** -- (Similar to TM 55-1520-248-23, Task 4-1-9)

Perform check run to verify leakage corrected

Return to service

Oil from three sources can leak into the exhaust collector flow path and result in excessive oil consumption:

- The compressor diffuser vent enters the exhaust collector on the left forward side. Excessive oil wetness indicates improperly sized orifice.
- The gearbox breather vents into the exhaust collector on the right forward side. Excessive oil wetness indicates a leaking breather gearshaft lip seal or extremely high gearbox internal breather pressure.
- Buffer air from the no. 5 labyrinth seal vents into the exhaust collector. Excessive laby seal clearance or inadequate buffer air pressure result in oil leaking into the inner hub fairing and forming puddles in the bottom of the exhaust collector. Inspect the exhaust collector flow path and determine whether any of these conditions exist.

Compressor diffuser vent leaking?

Yes

R-11 A (Pg 2)

Gearbox breather vent leaking?

Yes

R-11 B (Pg 2)

No. 5 labyrinth seal leaking?

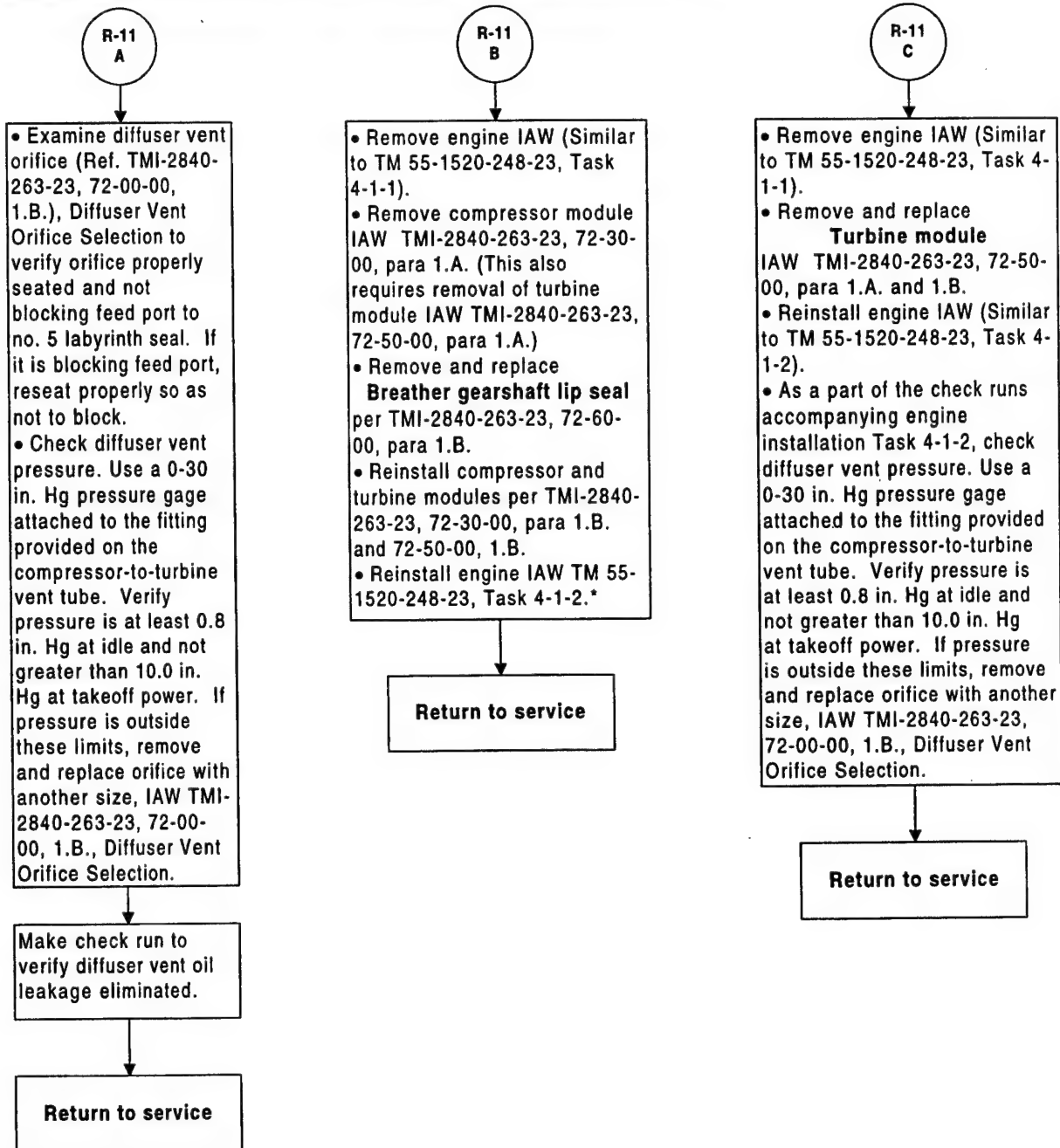
R-11 C (Pg 2)

R-11 D (Pg 3)

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## R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)

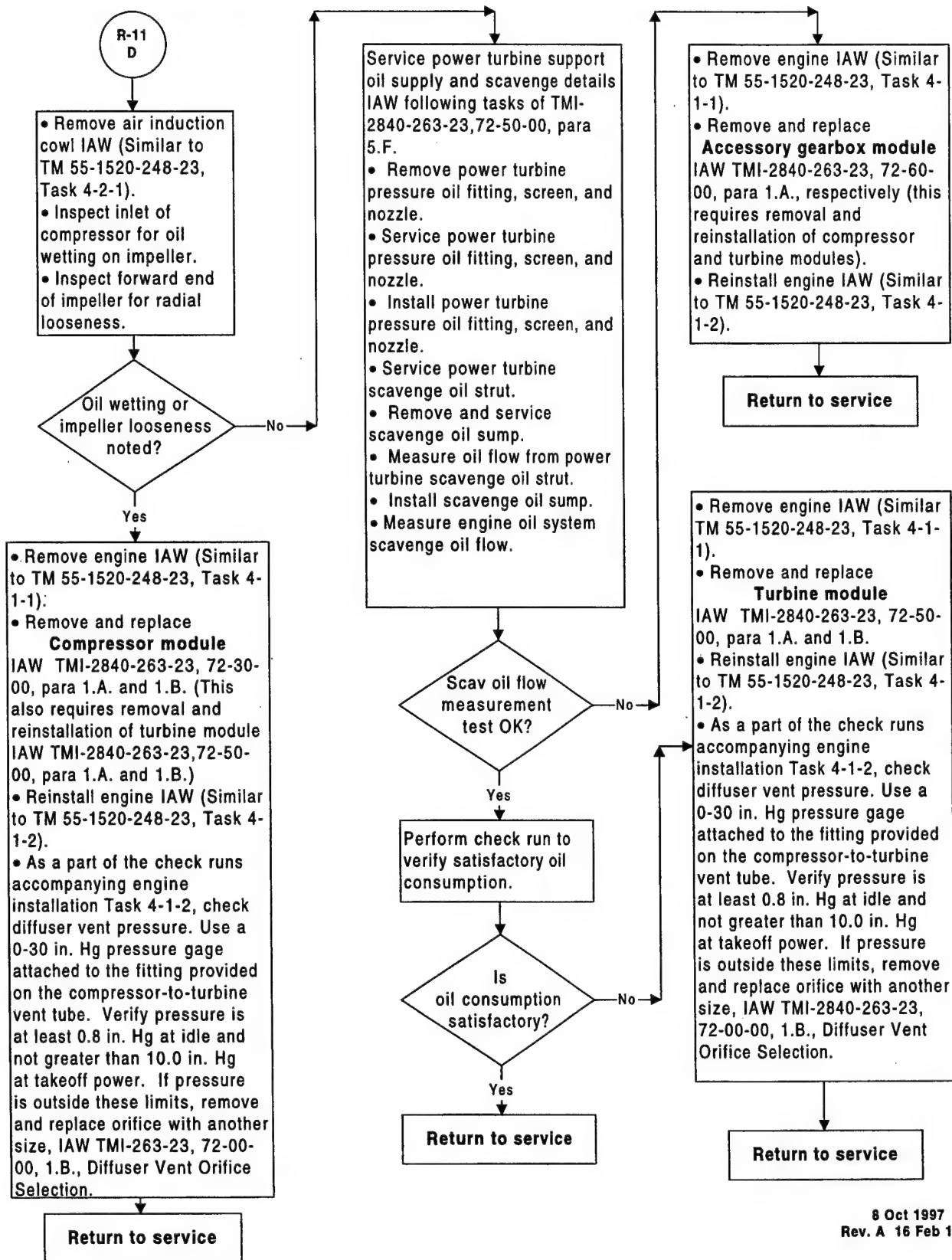
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# **R-11. Oil Consumption High (Exceeding One Quart Per Five Hours Engine Operation)**

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# R-12. Oil Leaking From Accessory Gearbox Drive(s)

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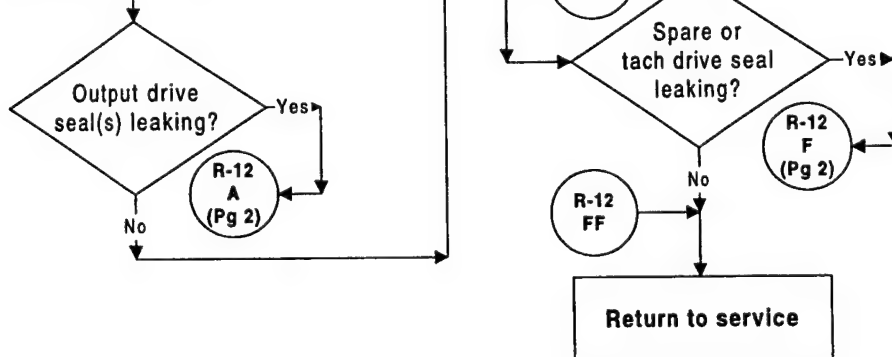
Lip-type oil seals are used for the engine output drives, engine component and accessory drives, and the accessory gearbox breather gearshaft.

If leakage from any of these seals is high enough to influence engine oil consumption rate or to oil down the engine compartment, the offending seal(s) may be replaced without removing the engine from the aircraft (except for the accessory gearbox breather gear seal).

The lip seals used in the engine are listed below. The gear train (Ng or Np) associated with each seal is also shown.

Np -- Output drive -- front  
 Np -- Output drive -- rear  
 Ng -- Starter-generator drive  
 Ng -- Tachometer drive  
 Np -- Tachometer drive  
 Ng -- Spare drive -- front  
 Np -- Spare drive -- rear  
 Ng -- HMU drive  
 Np -- PMA drive  
 Ng -- AGB breather gear

If a leaking seal requires replacement, proceed as follows:

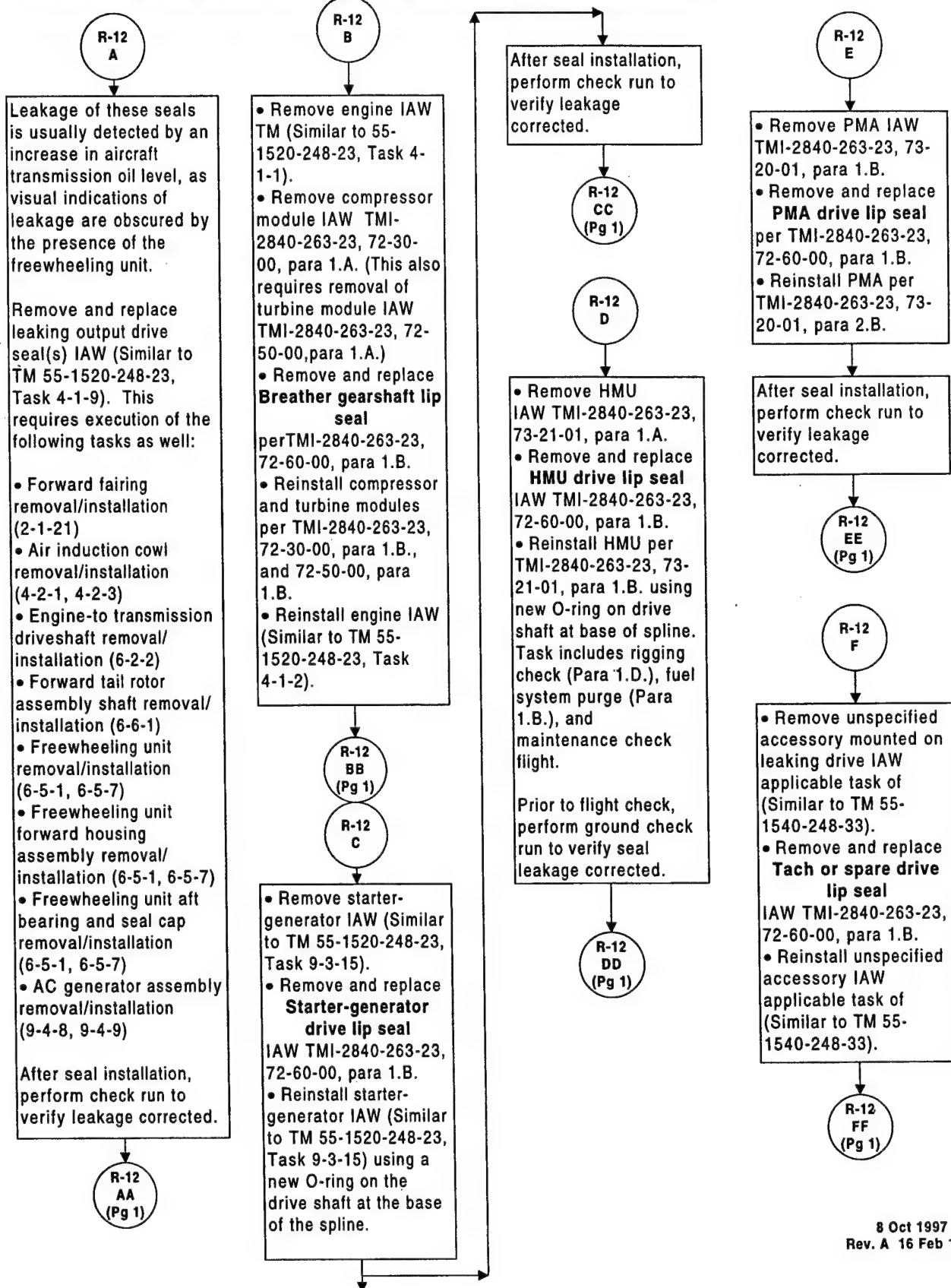


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## R-12. Oil Leaking From Accessory Gearbox Drive(s)

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# **R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature**

Page 1 of 3

There are several potential causes for a severe decrease in oil pressure at normal oil temperature. These include:

- Decrease in level of oil in the tank to the point where the oil pump inlet receives aerated oil
- An obstruction in the aircraft oil supply system
- A fault in the oil pressure transducer or cockpit indicator
- Leakage of oil transfer tubes between the oil pump and filter housing due to damaged O-rings, wear of the tube seal lands or bores into which they are inserted, or other internal oil leak
- Sticking of the oil pressure regulator valve or broken regulator spring
- Oil foaming, resulting in reduced oil flow
- Defective oil pump

If a severe drop in Main Oil Pressure (MOP) occurs during operation with normal engine oil temperature, proceed as follows to isolate and correct problem.

Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1)

More than 2 quarts needed to fill?

No

Yes

Perform a check run and determine whether MOP is satisfactory

MOP satisfactory?

Yes

Return to service

No

Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3,) as follows:

- Install pressure gage and tee fitting between sensing line and MOP transducer.
- Motor engine and bleed air from gage and sense line.
- Operate engine at 100% Np, warm oil until temperature stabilizes, and read gage and cockpit MOP indicator.

Does gage show normal MOP?

No

Yes

R-13  
A (Pg 2)

- Remove pressure gage and tee fitting.
- Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Motor engine and bleed air from transducer and sensing line.
- Operate engine at 100% Np, warm oil until temperature stabilizes, and read cockpit MOP indicator.

MOP satisfactory?

Yes

Return to service

No

Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23) Appendix K, Section III, and Tasks 8.1.5 through 8.1.8.

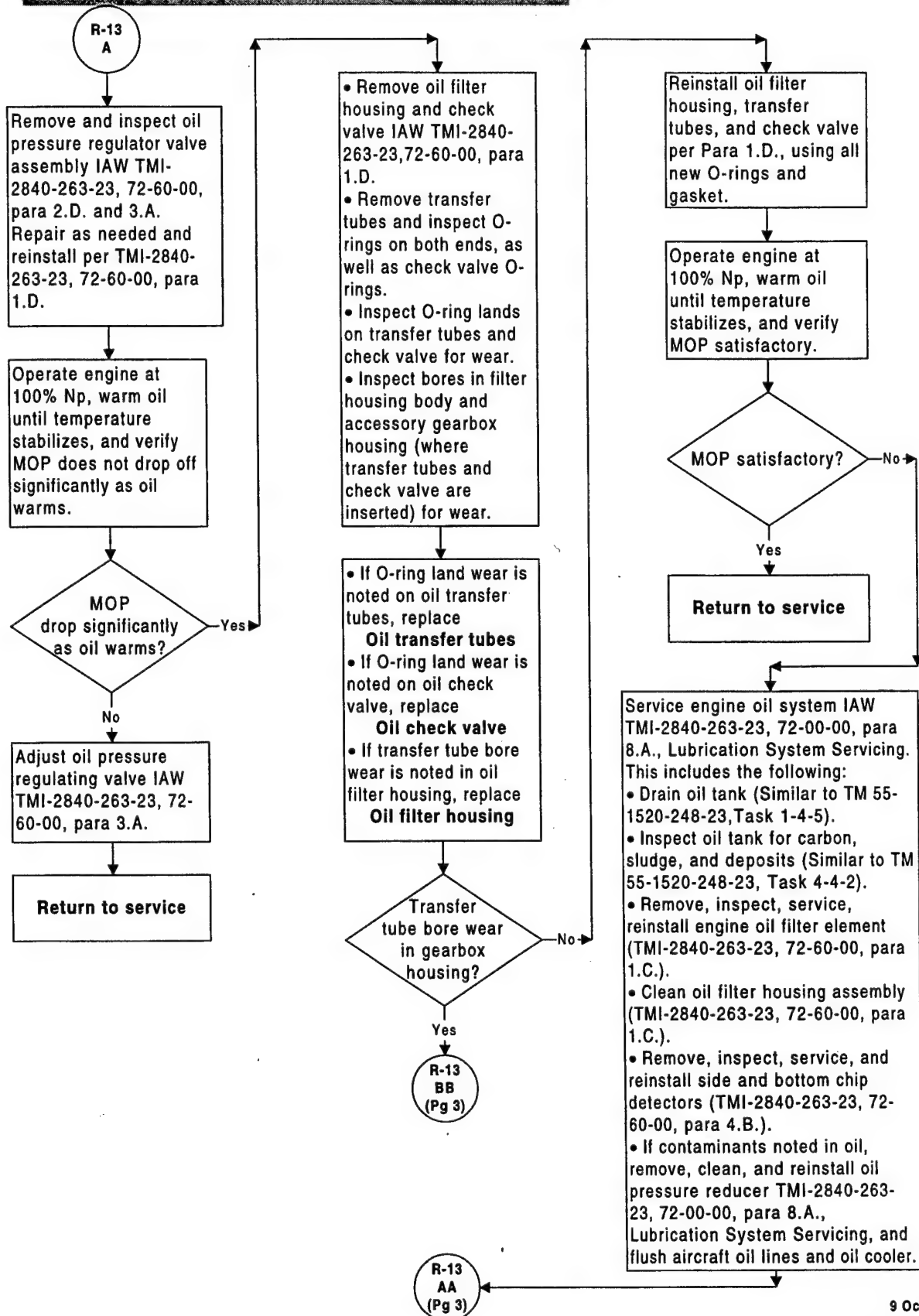
Operate engine at 100% Np, warm oil until temperature stabilizes, and verify satisfactory MOP.

Return to service

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# **R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature**

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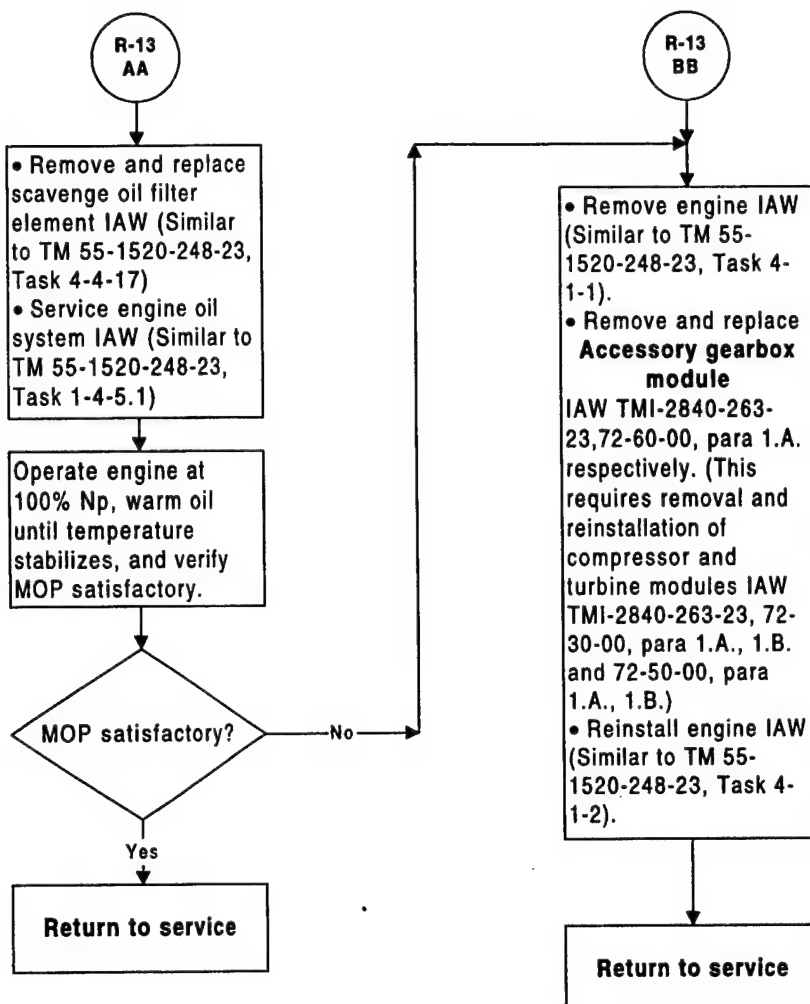


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## R-13. Oil Pressure Drops Off Severely With Normal Oil Temperature

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Rev. 11 Jul 99

# R-14. Oil Pressure Fluctuates

Page 1 of 3

The primary causes for oil pressure fluctuation are:

- Low oil tank level to the point where the oil pump inlet is receiving aerated oil
- Inadequate bleeding of oil pressure sensing line
- A fault in the oil pressure transducer or cockpit indicator
- Sticking of the oil pressure regulator valve
- An obstruction in the aircraft oil supply system
- Oil foaming, resulting in non-steady oil flow
- A defective oil pump or other lube system fault within the accessory gearbox

If significant fluctuations of Main Oil Pressure (MOP) occur during steady state engine operation, proceed as follows to isolate and correct problem.

Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).

More than 2 quarts needed to fill?

Yes

Perform a check run and determine whether MOP is stable.

MOP stable?

Yes

Return to service

Bleed Main Oil Pressure transducer line by loosening hose fitting at transducer. Motor engine with starter until solid stream of oil flows from fitting. Tighten fitting while engine is still motoring and oil is still flowing.

Perform a check run and determine whether MOP is stable.

MOP stable?

Yes

Return to Service

Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3) as follows:

- Install pressure gage and tee fitting between sensing line and MOP transducer.
- Motor engine and bleed air from gage and sensing line.

Perform a check run and determine whether MOP is stable on pressure gage.

Does gage show stable MOP?

Yes

- Remove pressure gage and tee fitting.
- Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Motor engine and bleed air from transducer and sensing line.

Perform a check run and determine whether MOP is stable on cockpit MOP indicator.

Does cockpit indicator show stable MOP?

Yes

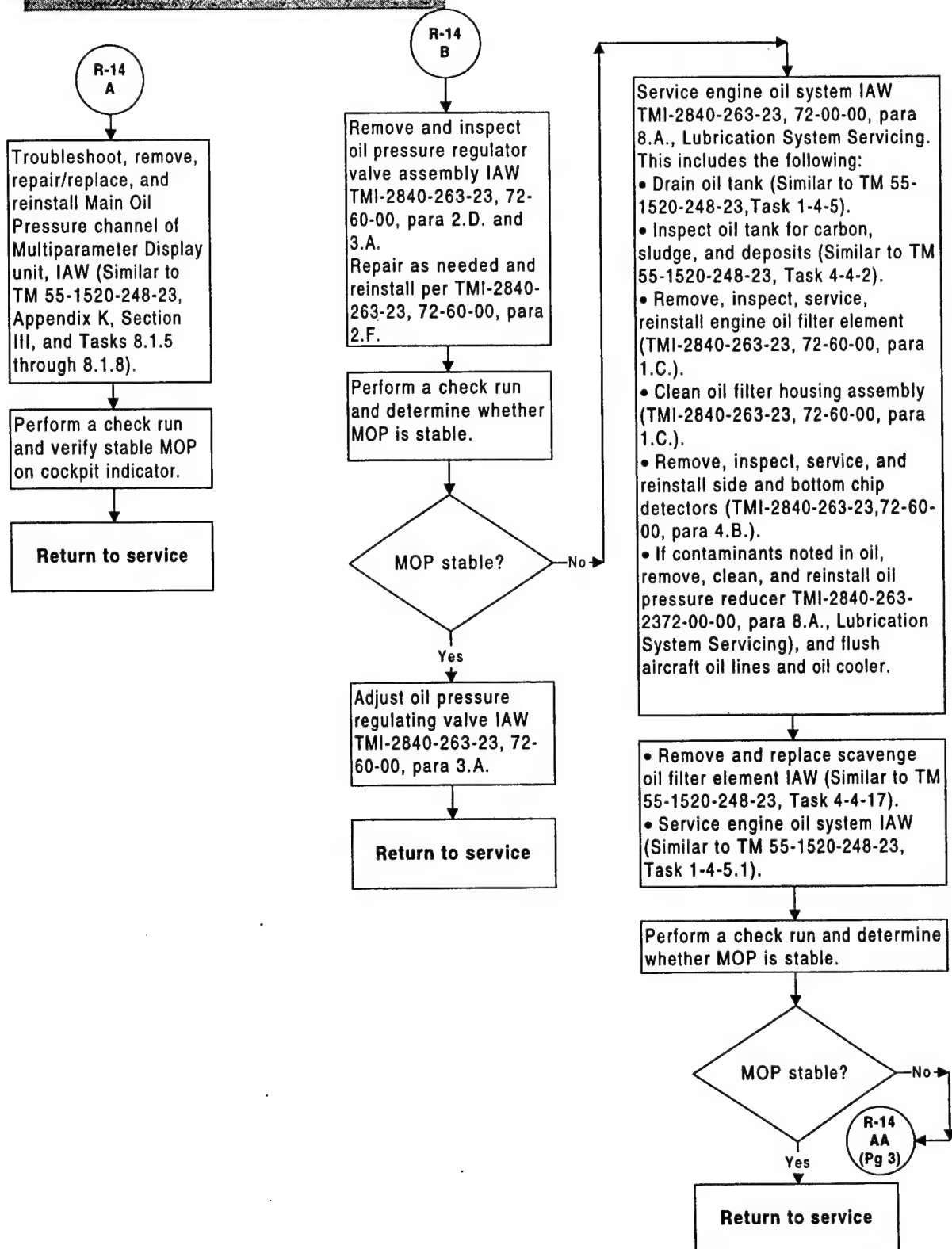
Return to service

R-14  
A  
(Pg 2)

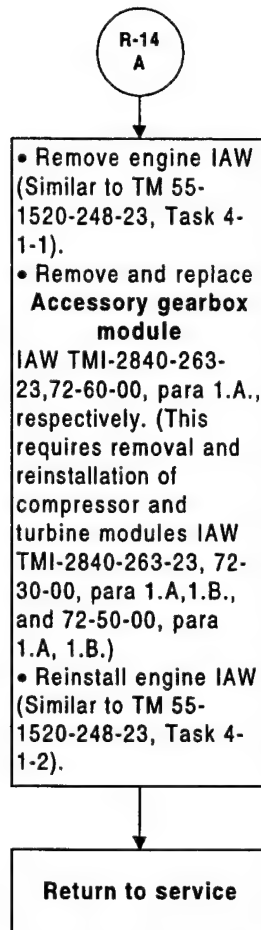
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## R-14. Oil Pressure Fluctuates

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# R-15. Oil Pressure Too High

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Main Oil Pressure (MOP) above 130 PSIG, when encountered with a newly installed engine or after parts changes that affect oil flow or MOP regulation, can be handled with an adjustment of the oil pressure regulator. A sudden increase for no obvious reason, however, is cause to suspect other oil system problems, whose diagnosis and correction should not be masked by an oil pressure regulator adjustment.

The most likely causes of high MOP are:

- Measurement error by aircraft MOP transducer or cockpit indicator
- Obstruction of pressure oil passage(s) within the accessory gearbox
- Blockage of oil supply to the turbine module or to one or both turbine oil nozzles

Only the first item can be corrected without engine removal for teardown, inspection, and repair.

If Main Oil Pressure above 130 PSIG is encountered (except immediately after an engine start during cold weather operations), proceed as follows to resolve.

Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3, as follows:)

- Install pressure gage and tee fitting between sensing line and MOP transducer.
- Motor engine and bleed air from gage and sensing line.

- Start the engine, and while maintaining allowable oil pressure limits as indicated by the gage, warm the oil to normal operating temperature.
- Increase power to light-on skids condition but not above 130 PSIG.
- Read pressure on gage and on cockpit indicator.

Does gage confirm high MOP?

No

- Remove pressure gage and tee fitting.
- Replace aircraft MOP transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-4).
- Motor engine and bleed air from transducer and sensing line.

Perform a check run and determine whether high MOP is still shown by cockpit indicator.

MOP satisfactory on cockpit indicator?

Return to service

Is this a newly installed engine?

Were parts changes affecting MOP just made?

R-15 A (Pg 2)

Adjust oil pressure regulating valve IAW TMI-2840-263-23, 72-60-00, para 3.A.

Return to service

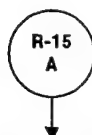
Troubleshoot, remove, repair/replace, and reinstall Main Oil Pressure channel of Multiparameter Display unit, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8-1-5 through 8-1-8).

Perform a check run and verify satisfactory MOP on cockpit indicator.

Return to service

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- Remove and  
**Replace engine**  
IAW (Similar to TM 55-1520-248-23, Tasks 4-1-1 and 4-1-2).
- Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing and (Similar to TM 55-1520-248-23, Task 1-4-5.1).
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Flush aircraft oil lines and oil cooler.

## R-16. Oil Pressure Too Low

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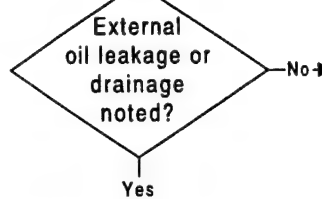
Low Main Oil Pressure (below 115 PSIG), when encountered with a newly installed engine or after parts changes that affect oil flow or MOP regulation, can be handled with an adjustment of the oil pressure regulator. A sudden or progressive decrease for no obvious reason, however, is cause to suspect other oil system problems, whose diagnosis and correction should not be masked by an oil pressure regulator adjustment.

The most likely causes of low MOP are:

- Decrease in level of oil in the tank to the point where the oil pump inlet is receiving aerated oil
- External oil leak
- Obstruction in the aircraft oil supply system
- Clogged oil filter
- A fault in the aircraft oil pressure transducer or cockpit indicator
- Sticking oil pressure regulator valve or broken regulator spring
- Leakage of oil transfer tubes between the oil pump and filter housing due to cut O-ring, wear of the tube seal lands or bores into which they engage, or other internal oil leak
- Excessive oil temperature resulting from aircraft oil cooler (or related) fault
- Oil foaming, resulting in reduced oil flow
- A defective oil pump

If Main Oil Pressure is not at least 50 PSIG from Ground Idle to 79% Ng, 90 PSIG from 79% to 94% Ng and 115 PSIG at speeds above 94% Ng, perform the following sequence to isolate and resolve the problem:

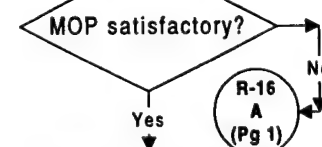
Visually inspect the engine, lube system, and drains for external leakage.



Locate source(s) of leakage and correct as follows:

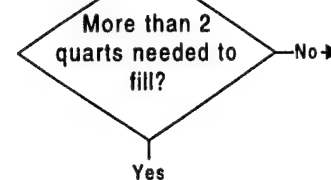
- TUBE ENDS, HOSE ENDS, FITTINGS, ETC. -- tighten, repair, or replace as required
- EXTERNAL LUBE SYSTEM COMPONENTS -- repair or replace IAW (Similar to TM 55-1520-248-23:  
Oil tank -- Tasks 4-4-1 through 4-4-8  
Oil cooler bypass valve -- Task 4-4-9  
Oil scavenge filter -- Task 4-4-18)

- Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).
- Perform check run to verify satisfactory MOP (very brief if MOP below limits).

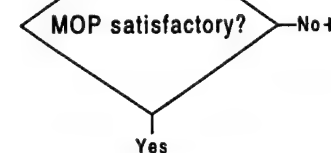


Return to service

Check oil level in tank and replenish IAW (Similar to TM 55-1520-248-33, Task 1-4-5.1).



Perform check run to verify satisfactory MOP (very brief if MOP below limits).



Return to service

R-16 A

Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3), as follows:

- Install pressure gage and tee fitting between sensing line and MOP transducer.
- Motor engine and bleed air from gage and sensing line.
- Operate engine at 100% Np and read gage and cockpit MOP indicator. If MOP is within limits on gage, continue to operate until oil temperature stabilizes and recheck gage and cockpit indicator).

Check the engine oil pressure transducer IAW (Similar to TM 55-1520-248-23, Task 4-1-3), as follows:

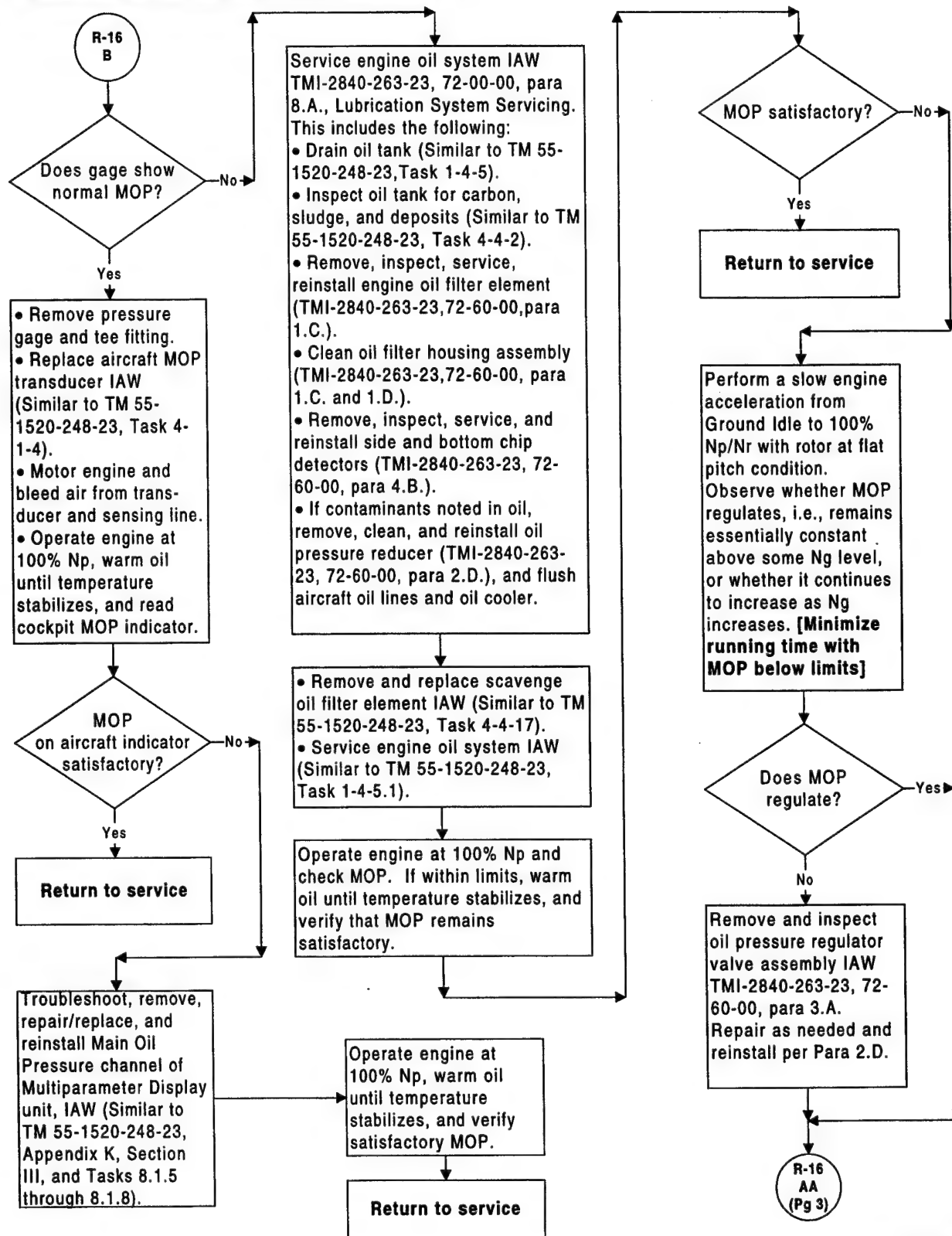
- Install pressure gage and tee fitting between sensing line and MOP transducer.
- Motor engine and bleed air from gage and sensing line.
- Operate engine at 100% Np and read gage and cockpit MOP indicator. If MOP is within limits on gage, continue to operate until oil temperature stabilizes and recheck gage and cockpit indicator).

R-16 B (Pg 2)

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# R-16. Oil Pressure Too Low

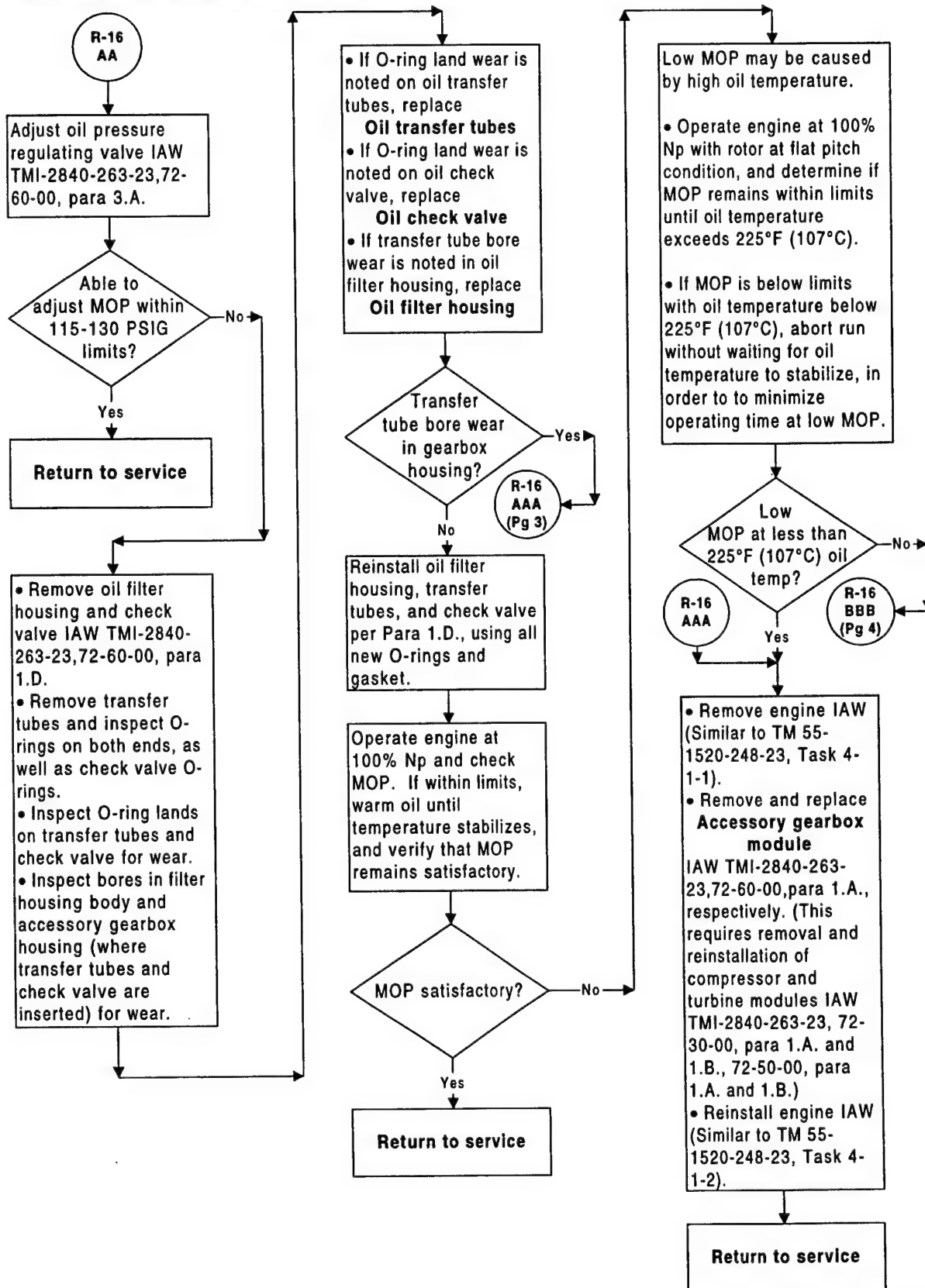
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## R-16. Oil Pressure Too Low

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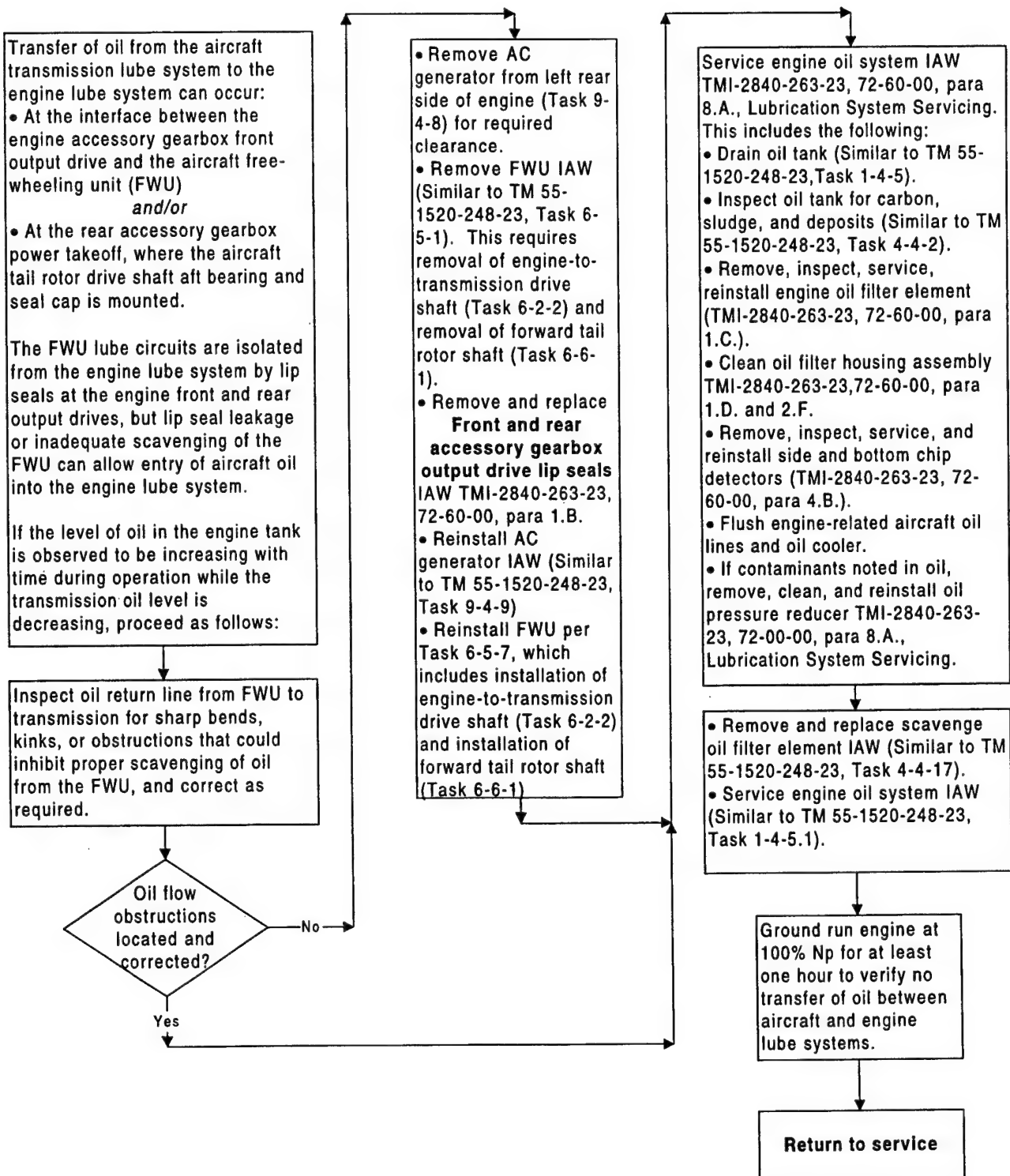
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# R-17. Engine Oil Tank Fills During Flight As Aircraft Transmission Oil Level Decreases

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# **R-18. Aircraft Transmission Oil Level Increases During Flight As Engine Oil Tank Empties**

Page 1 of 3

Transfer of oil from the engine lube system to the aircraft transmission lube system can occur:

- At the interface between the engine accessory gearbox front output drive and the aircraft free-wheeling unit (FWU) and/or
- At the rear accessory gearbox power takeoff, where the aircraft tail rotor drive shaft aft bearing and seal cap is mounted

The FWU lube circuits are isolated from the engine lube system by lip seals at the engine front and rear output drives, but lip seal leakage can allow entry of engine oil into the aircraft lube system, particularly when driven by an abnormally high accessory gearbox breather pressure.

If the level of oil in the transmission is observed to be increasing with time during operation while the engine oil tank level is decreasing, proceed as follows:

Inspect the accessory gearbox breather exit port, on the right forward side of the exhaust collector, for excessive oil wetness or puddling. This is indicative of high accessory gearbox internal breather pressure (or of a leaking breather gearshaft lip seal).

Excessive oil wetness around breather exit port?

No  
R-18 B  
(Pg 3)

Oil loss through the accessory gearbox breather vent can be caused by:

- Excessive compressor seal vent pressure
- Breather gearshaft lip seal leakage
- Excessive internal pressure resulting from worn or damaged turbine labyrinth seals

- Examine diffuser vent orifice TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection, to verify orifice properly seated and not blocking feed port to No. 5 labyrinth seal. If it is blocking feed port, reseal properly so as not to block.
- Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Was it necessary to install larger orifice?

No  
R-18 A  
(Pg 2)

Make a check run at 100% Np and determine whether wetness still exists around gearbox breather exit port.

Breather exit port still wet with oil?

Yes  
R-18 A  
(Pg 2)

Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

Any oil transfer from engine to transmission?

Yes  
R-18 B  
(Pg 3)

- Drain transmission oil IAW (Similar to TM 55-1520-248-23, Task 1-4-6).
- Drain FWU per Task 1-4-6.
- Remove/clean/replace transmission filters per Tasks 1-4-6, 1-4-6.1, 6-8-3.
- Refill and service transmission per Task 1-4-6.1.

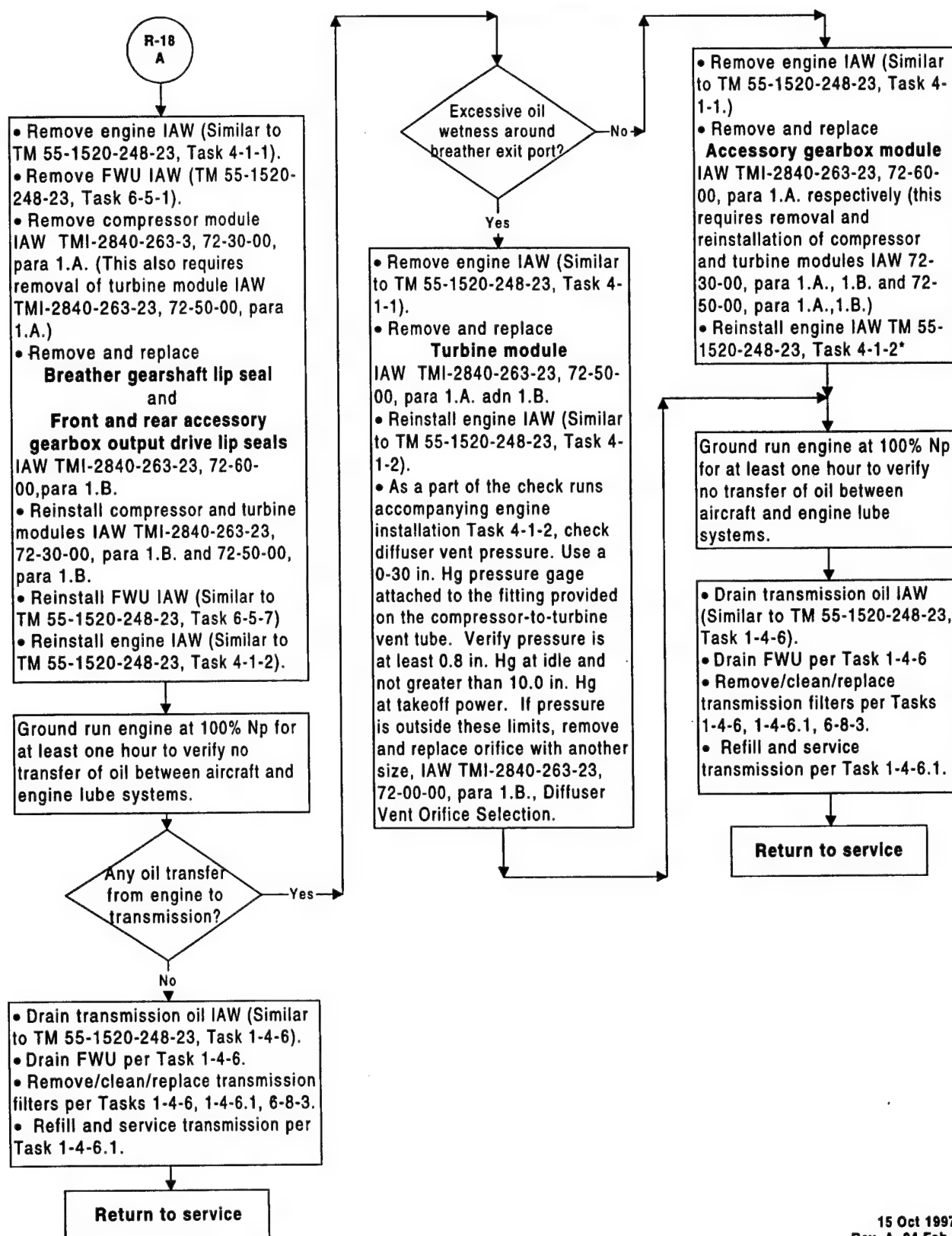
Ground run engine at 100% Np for at least one hour to verify no transfer of oil between aircraft and engine lube systems.

Return to service

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# **R-18. Aircraft Transmission Oil Level Increases During Flight As Engine Oil Tank Empties**

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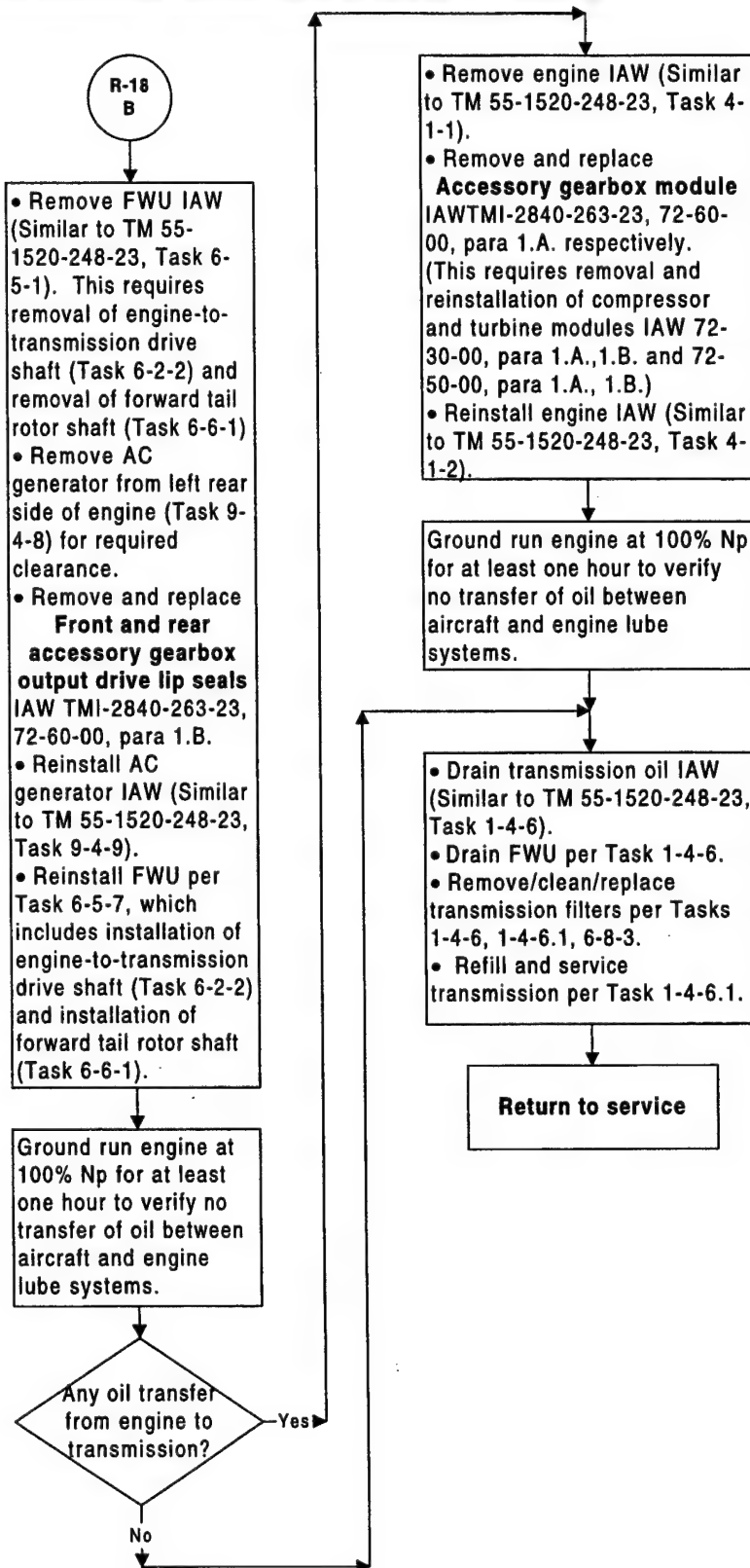


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## R-18. Aircraft Transmission Oil Level Increases During Flight As Engine Oil Tank Empties

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## R-19. Oil Spewing Or Seeping From Compressor Vent Orifice And Tubing Joints

Page 1 of 1

The compressor diffuser vent system, which provides buffering pressure to the compressor impeller rear inner labyrinth seal and the turbine No. 5 labyrinth seal, consists of a 2-piece tube, flanged on both ends with slip joint between, and gaskets at the flanges. At the forward end, the tube connects to a mating flange on the compressor diffuser, and, at the aft end, to another flange on the turbine exhaust collector. A size-selected orifice, which controls vent system pressure, is located at the exhaust collector end.

If the vent pressure is too low, oil can leak past either or both of the labyrinth seals, the compressor seal into the vent tube and thence into the exhaust collector, and the No. 5 seal into the exhaust collector hub fairing. If the pressure is too high, it increases internal breather pressure in the accessory gearbox, which raises oil consumption by increasing oil blown overboard through the AGB breather vent.

If oil spewing or seeping from the diffuser vent orifice or tubing joints is encountered, the vent pressure must be adjusted by orifice resizing.

Proceed as follows:

- Remove vent tube (both sections), IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.
- Examine diffuser vent orifice to verify orifice properly seated and not blocking feed port to No. 5 labyrinth seal. If it is blocking feed port, reseal properly so as not to block.
- Check flatness of vent tube flange faces. Replace either or both if bent or distorted.
- Reassemble with new gaskets.

- Check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Ground run the engine and verify pressure is at least 0.8 in. Hg at Ground Idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove and replace orifice with another size, IAW TMI-2840-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

Return to service

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## R-20. Oil Spewing Or Seeping From Gearbox Vent And Tubing Joints

Page 1 of 2

The accessory gearbox overboard vent system is comprised of a breather gear that centrifugally separates oil droplets from air within the gearbox, before venting the air overboard through the gear hub. The vent air passes through an internal passage in the gearbox housing to an elbow fitting atop the gearbox. From there, it passes through a tube with an O-ring sealed slip joint to a flanged fitting on the front of the turbine exhaust collector (right side), where it passes overboard into the engine exhaust stream.

The only potential site for external seeping is the flange at the exhaust collector, which is sealed with a gasket. The slip joint has no leakage potential as long as the O-ring is intact.

Spewing into the exhaust stream can result from leakage of the lip seal on the centrifugal breather gearshaft, which bypasses the gear and does not benefit from the separating action. Another source is excessive air leakage into the gearbox, from too high compressor seal vent pressure or from worn or damaged turbine seals in cooling air or pressure balance circuits.

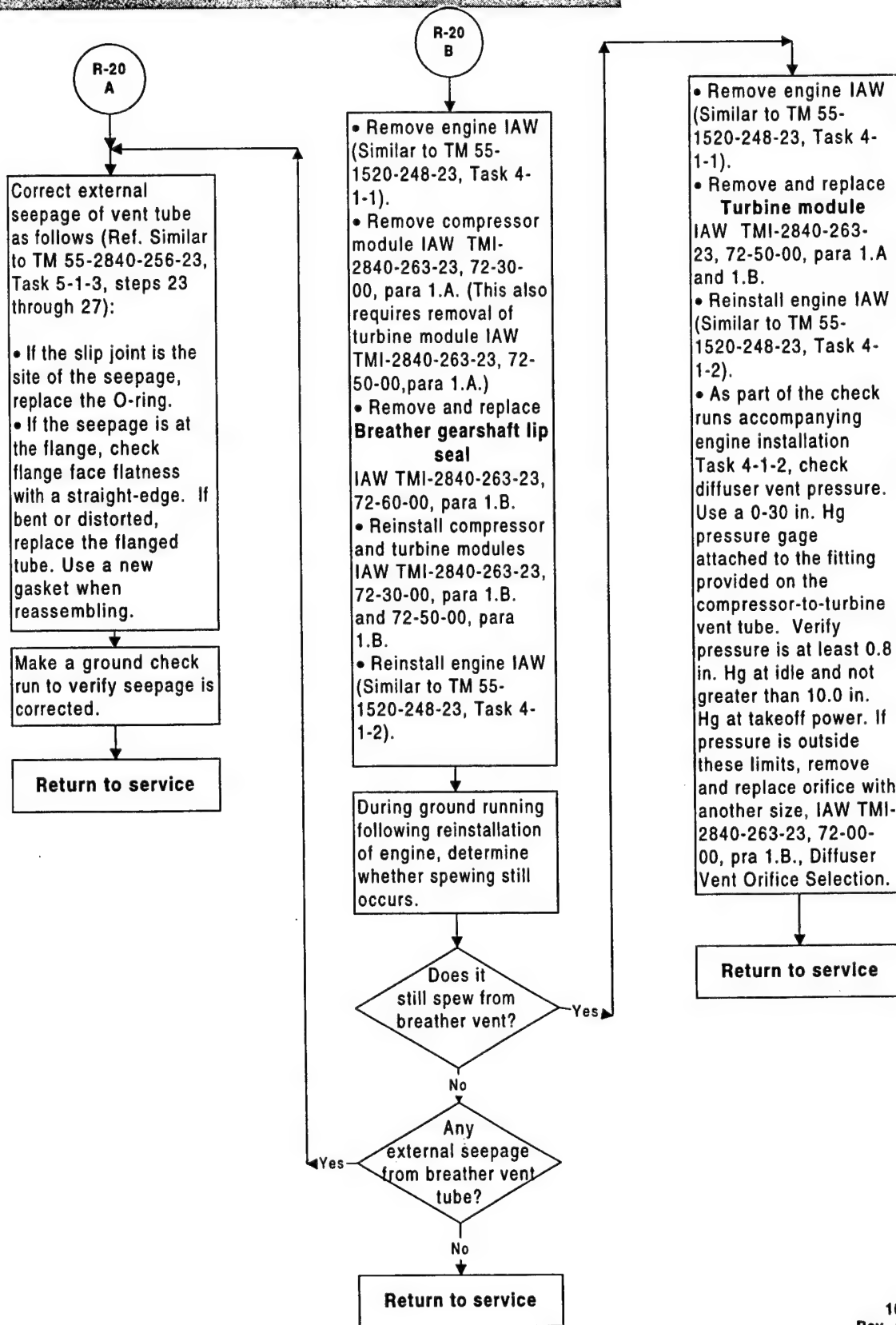
If oil spewing or seeping from the accessory gearbox breather vent or tubing joints is encountered, proceed as follows:



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## R-20. Oil Spewing Or Seeping From Gearbox Vent And Tubing Joints

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# R-21. Oil Temperature Exceeds 107°C (225°F)

Page 1 of 3

Engine main oil temperature (MOT) -- the temperature of oil supplied to the engine from the oil tank -- is limited to 107°C (225°F) on a continuous basis. It may exceed that temperature, up to as high as 120°C (248°F) for not more than 10 minutes, if the engine is inspected afterward. If the oil temperature exceeds 120°C (248°F) for **any** period of time, however brief, the engine must be removed from the aircraft and sent to a maintenance/overhaul facility for inspection and repair.

Causes of high MOT indication are usually either:

- Erroneous MOT measurement, involving the cockpit indicator, the oil temperature transducer, or the interconnecting wiring **or**
- Problems in the aircraft oil cooling system (cooler, cooler temperature control valve, cooler fan, or cooler bypass valve).

If indicated oil temperature exceeded 107°C (225°F), proceed as follows:

Check calibration of MOT measurement system as follows:

- Drain oil tank IAW (Similar to TM 55-1520-248-23, Task 1-4-5).
- Remove oil temperature transducer from oil tank per Task 4-4-6.
- With oil temperature transducer connected electrically and aircraft powered up per Task 9-3-10, place transducer in container of boiling water. Allow to stabilize at a gentle boil and read cockpit MOT indication on Multiparameter Display unit (MPD). Compare reading with temperature of boiling water at the prevailing barometric pressure.

MPD within 5°F (2.8°C) of boiling water temp?

Yes  
R-21 B (Pg 2)

No

Obtain another known good oil temperature transducer and repeat calibration check in boiling water.

MPD within 5°F (2.8°C) of boiling water temp?

Yes  
R-21 A (Pg 2)

No

Troubleshoot, remove, repair/replace, and reinstall Main Oil Temperature channel of Multiparameter Display unit or related aircraft wiring, IAW (Similar to TM 55-1520-248-23, Appendix K, Section III, and Tasks 8.1.5 through 8.1.8.).

During boiling water checks, was MPD reading too high?

Yes

High enough to disprove oil overtemperature?

Yes

MPD read about the same with both temp transducers?

Yes

Reinstall the original oil temperature transducer in the oil tank IAW (Similar to TM 55-1520-248-23, Task 4-4-6. Service oil tank per 1-4-5.1).

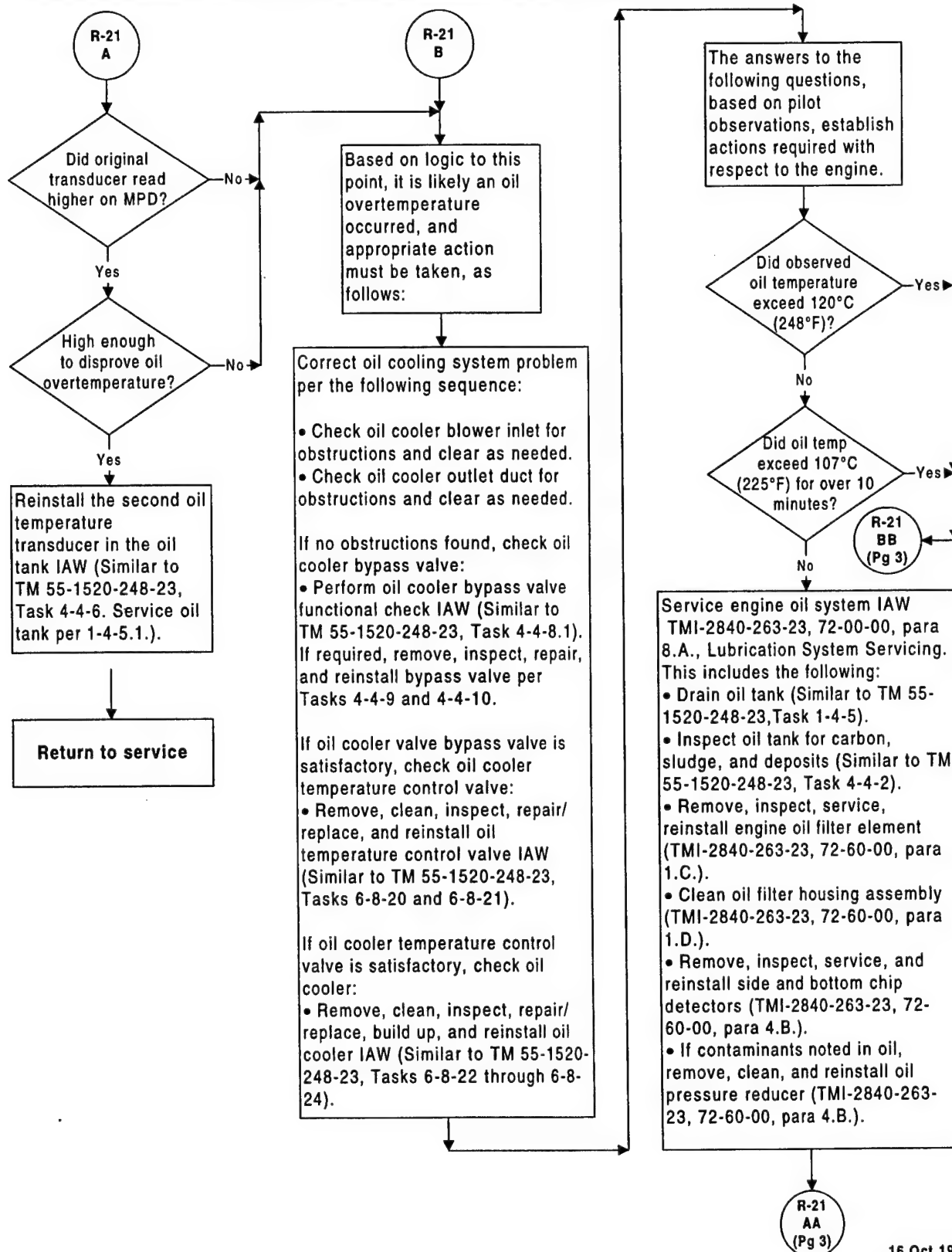
Reinstall the second oil temperature transducer in the oil tank IAW (Similar to TM 55-1520-248-23, Task 4-4-6. Service oil tank per 1-4-5.1).

Return to service

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# R-21. Oil Temperature Exceeds 107°C (225°F)

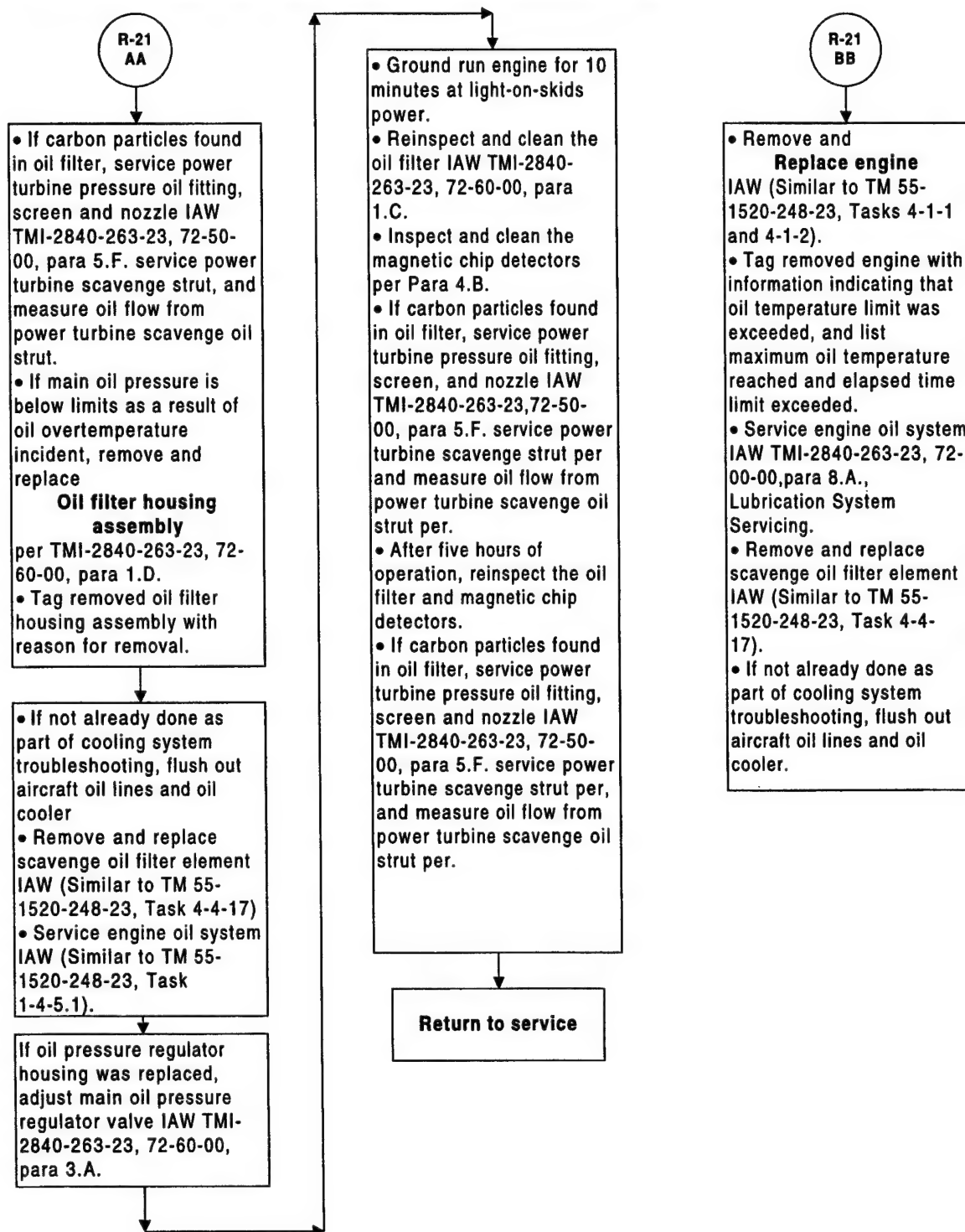
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## R-21. Oil Temperature Exceeds 107°C (225°F)

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# R-22. Power Low With High MGT

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The low power/high MGT condition can result from many factors, among which are:

- Inlet obstruction
- Compressor inducer bleed restriction or detachment
- Dirty compressor
- Damaged compressor
- Instrumentation errors in MGT or Torque measurement
- Anti-icing air leak
- Cabin heater air leak
- Compressor air leak
- External air leak
- Turbine internal leak
- Turbine damage
- Combustor distortion, cracking, burning

If MGT has shifted high on the Power Assurance Check trend line use the sequence below to diagnose and correct.

Inspect inducer bleed duct for security of attachment at both ends and freedom from restriction (Similar to Ref. TM 55-1520-248-23, Task 2-1-24).

Was bleed duct detached or restricted?

R-22 AA

R-22 A (Pg 2)

Test anti-icing system IAW TMI-2840-263-23, 75-01-00, para 4.A. and 4.B.

Was anti-icing system function OK?

R-22 BB

R-22 B (Pg 2)

Isolate cabin heater by disconnecting aircraft bleed air tube at cabin heater mixing valve inlet and plugging end of tube.

Perform power assurance check.

Expected performance level restored?

R-22 C (Pg 2)

- Remove the air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-1).
- Inspect the compressor inlet for blockage or obstruction.
- Inspect the inlet particle separator panels and tubes for damage or blockage.
- Inspect compressor for damage to inlet guide vanes or impeller vanes, or rub or erosion of shroud lining in vicinity of impeller vane tips.

Compressor blockage or damage noted?

R-2 D (Pg 2)

Reinstall air induction cowl IAW (Similar to TM 55-1520-248-23, Task 4-2-3). Detergent spray, hand wash, and water rinse compressor rotor IAW TMI-2840-263-23, 72-30-00, para 4.A. and 4.B.

Perform power assurance check.

Expected performance level restored?

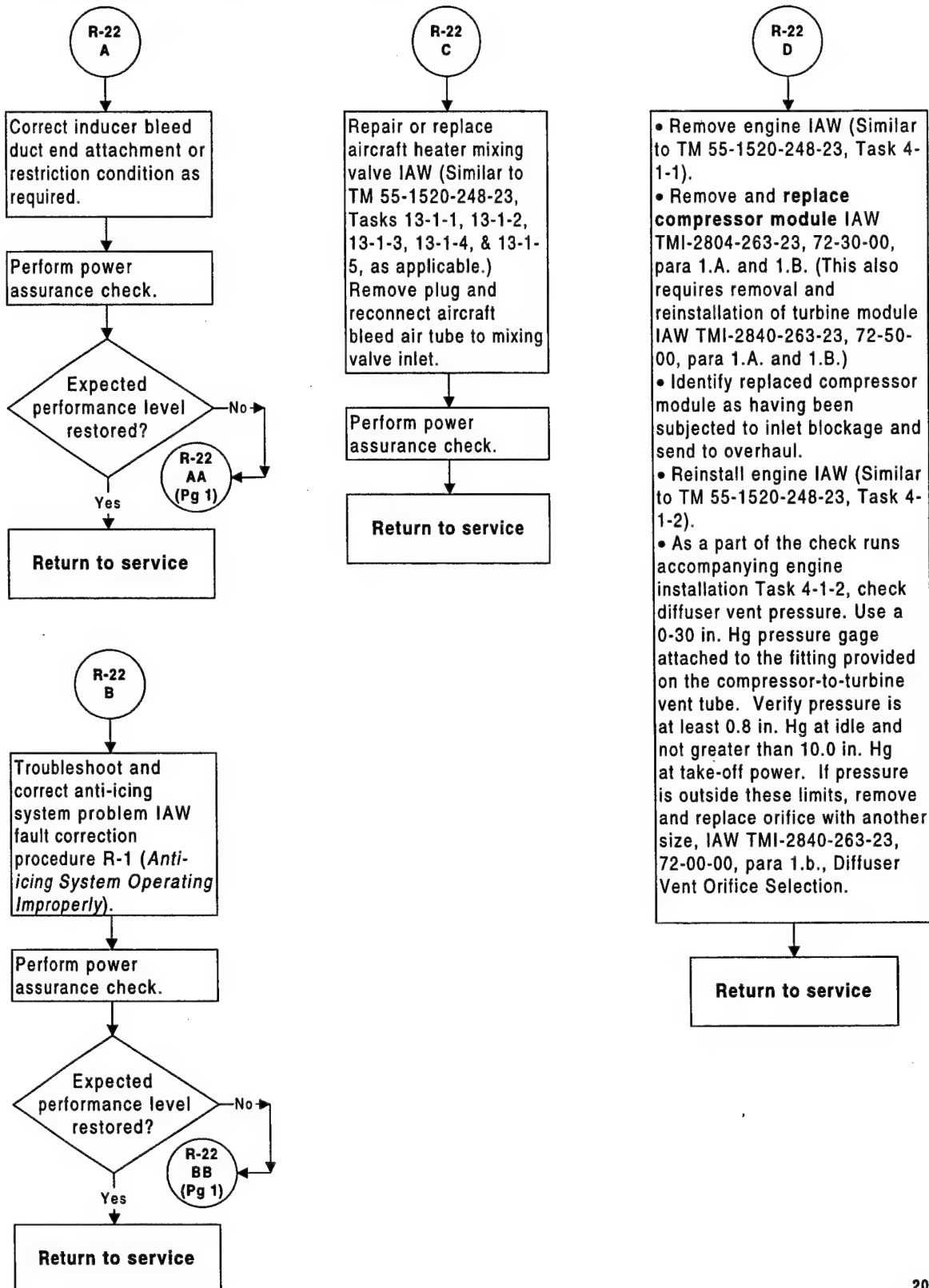
Return to service

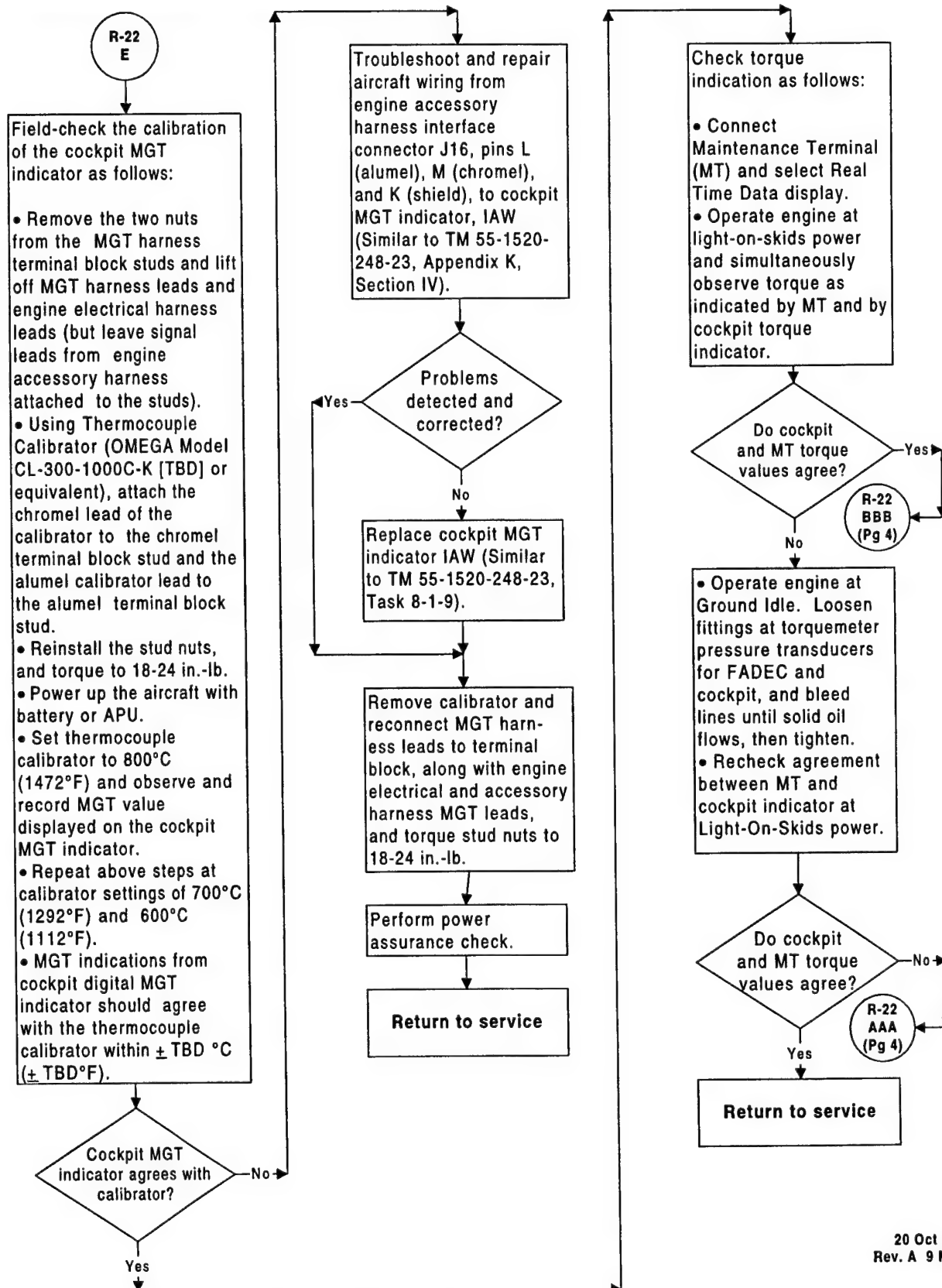
R-22 E (Pg 3)

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## R-22. Power Low With High MGT

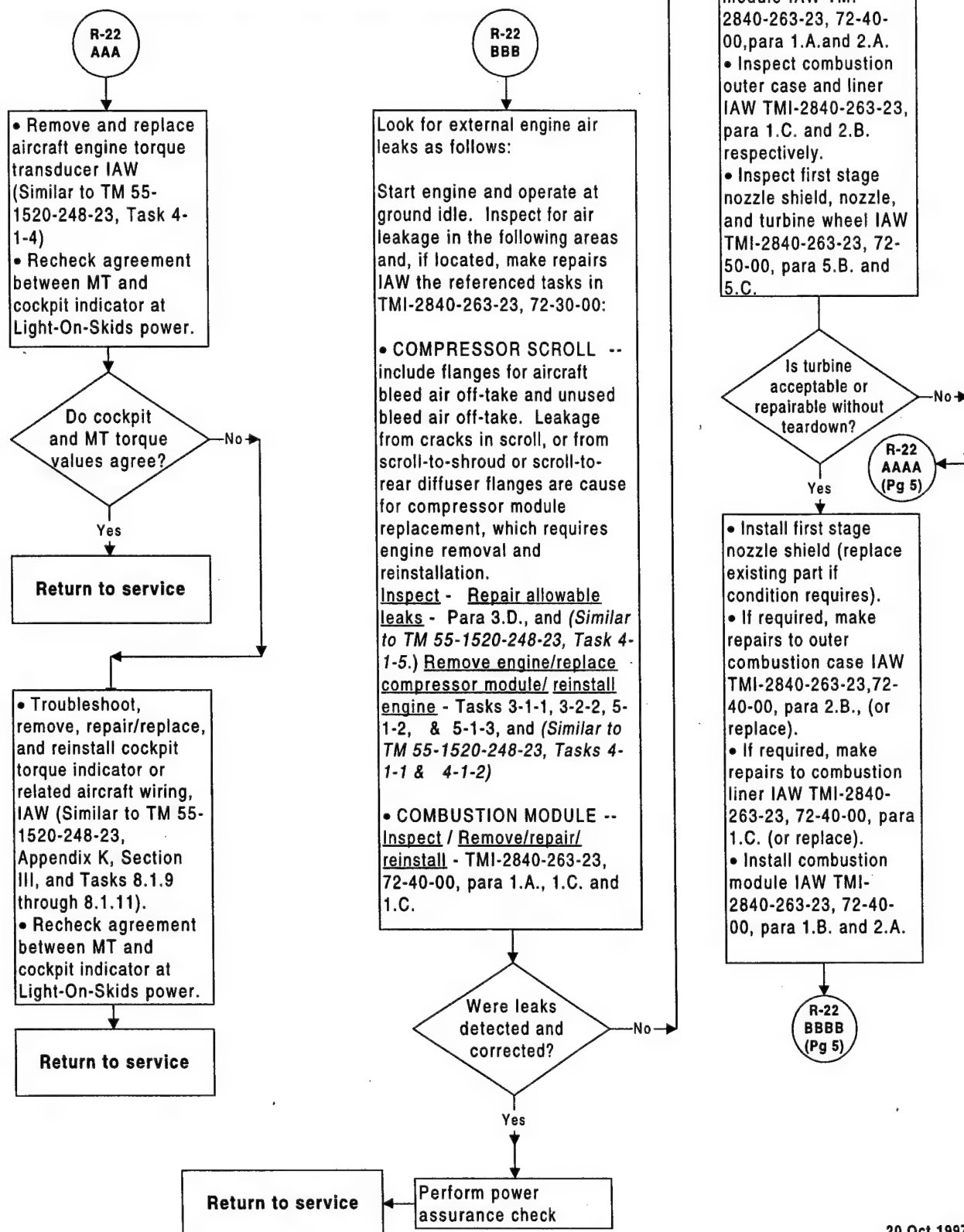




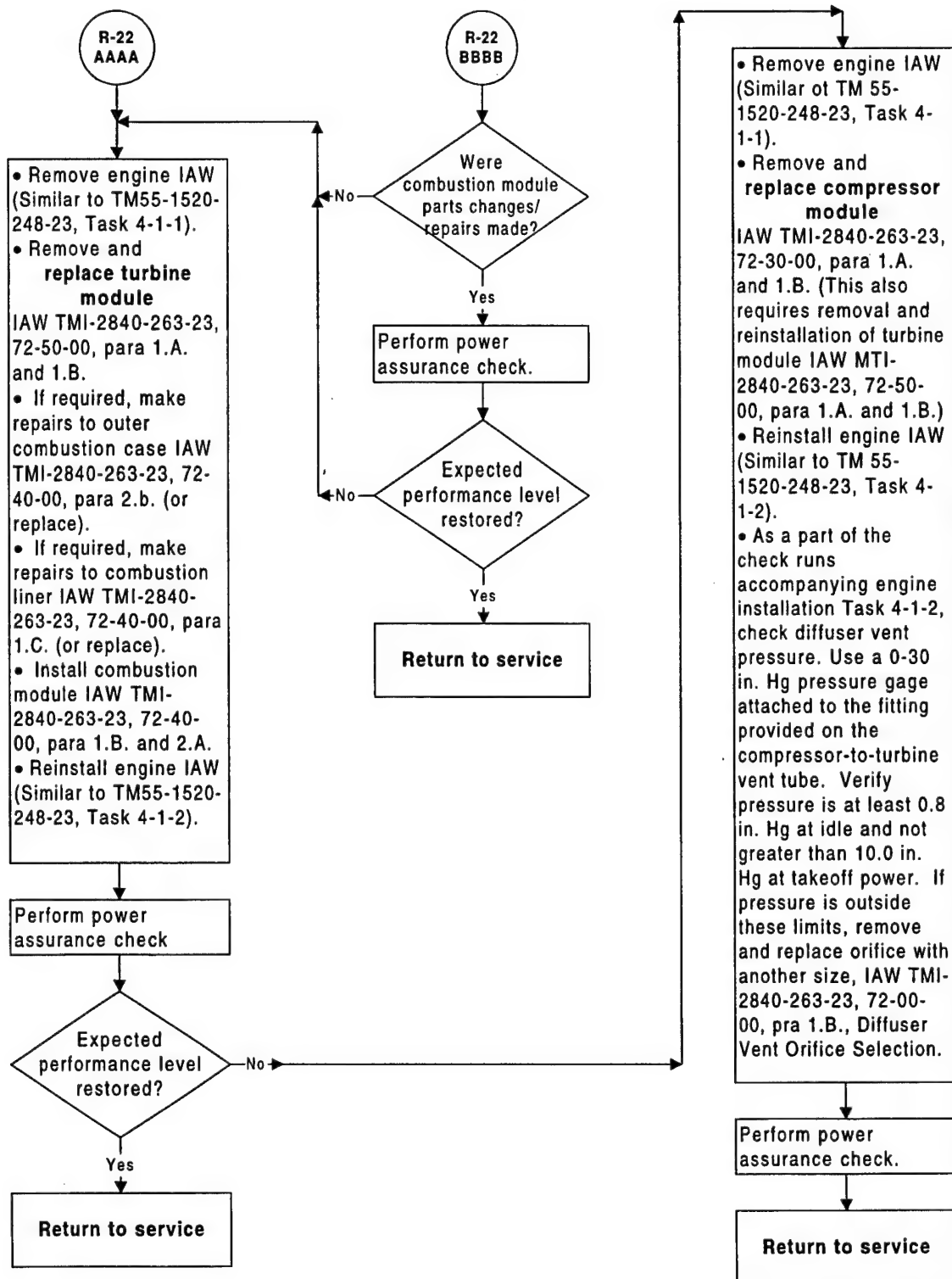
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## R-22. Power Low With High MGT

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## R-23. Power Low With MGT Below Maximum Limit

Page 1 of 2

The inability to reach high power conditions, with correspondingly low MGT, is probably caused by one of the following:

- Misrigging of the linkage from the throttle twist grip to the HMU power lever, preventing travel to the maximum stop on the HMU
- A travel restriction in the aircraft rotor system that limits collective pitch application.
- Low engine fuel inlet pressure, resulting in inadequate fuel supply
- A fault in the ECU or HMU

If unable to reach high power, with a correspondingly low MGT, proceed as follows to correct condition:

Connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear. If, as a result, any relevant parts were replaced or procedures performed, operate the engine at high power and determine whether the problem is corrected.

Able to reach high power satisfactorily?

Yes

Return to service

No

- Inspect fuel control rigging IAW TMI-2840-263-23, 73-21-01, para 1.D.
- If required, re-rig throttle linkage IAW (Similar to TM 55-1520-248-23, Task 4-6-1).

Rerigging required?

Yes

Operate the engine at high power and verify that the problem is corrected.

Return to service

No

- Check Multifunction display memory for Fuel Filter Bypass caution.
- Check engine fuel filter pop-out for extension.

Fuel filter in bypass or impending bypass mode?

No

Yes

- Remove and replace engine fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
- Purge fuel system per TMI-2840-263-23, 73-00-00, para 1.B.

Operate the engine at high power and verify that the problem is corrected.

Return to service

Verify full travel of collective pitch linkage. Correct as required

Was travel restricted in the increase direction?

Yes

No

R-23 A (Pg 2)

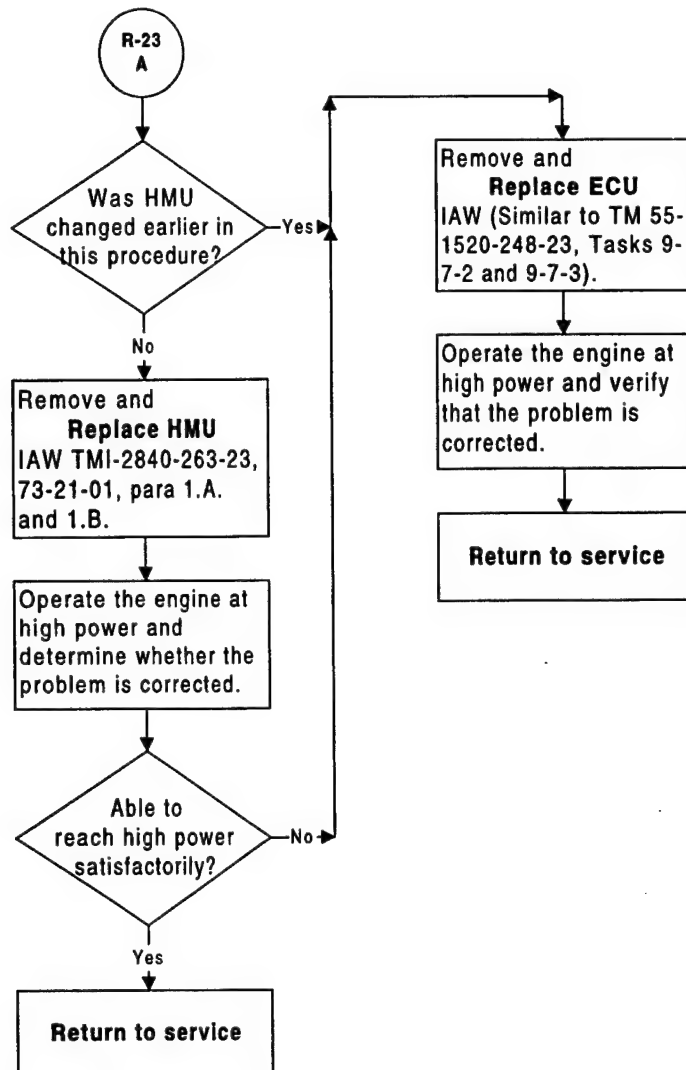
Operate the engine at high power and verify that the problem is corrected.

Return to service

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## R-23. Power Low With MGT Below Maximum Limit

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## R-24. Slow Acceleration/Np Droop

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Loss of the FADEC droop anticipation feature results in greater than normal Np/Nr droop and a slight delay in the onset of acceleration during collective pulls.

A position potentiometer in the collective pitch linkage is the source of the droop anticipation signal. If misrigged or failed, delayed accelerations and increased Np/Nr droop will occur and the control system will declare a FADEC DEGRADE Advisory on the MFD. A failure within the ECU can also produce these same symptoms.

Connect the Maintenance Terminal and query the Display Faults (Static) page for Current and Last Run faults. A **CPFit** should be listed (possibly along with other faults resulting from the primary CP position fault), or a fault related to an ECU failure.

- Troubleshoot the collective pitch signal fault problem by replacing the potentiometer and/or repairing faulty aircraft wiring, IAW (Similar to TM 55-1520-248-23, Appendix K, Section IV).
- If collective pitch potentiometer is replaced, rig per (Similar to TM 55-1520-248-23, Task 11-2-1, steps 18 through 26).

Clear any other maintenance faults indicated by the Maintenance Terminal.

Perform a check flight to verify satisfactory accelerations and Np/Nr droop.

Return to service

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# R-25. Smoking During Steady State Operation

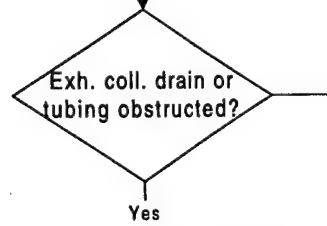
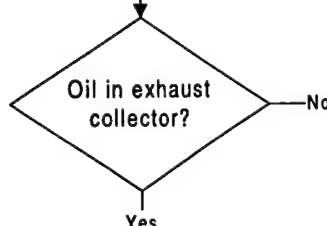
Page 1 of 4

Continuous plumes or prolonged (several second) bursts of white (oil) smoke from the engine exhaust are probably the result of one or more of the below listed faults:

- Exhaust collector drain blocked
- Leaking No. 1 carbon seal
- Failed No. 1 bearing
- Blocked power turbine scavenge strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenge flow from turbine
- Restricted scavenge flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

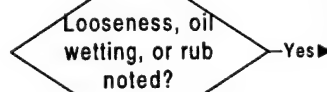
Inspect the turbine exhaust collector for wetness, oil puddling, and drain blockage.



Correct obstruction and make check run to verify smoking eliminated.



Return to service



R-25 B (Pg 3)

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove and replace

## Compressor module

IAW TMI-2840-263-23, 72-30-00, para 1.A. and 1.B. (this also requires removal and reinstallation of turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A. and 1.B.).

- Reinstall engine IAW (Similar to TM 55-1520-248-23, Task 4-1-2).

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing. This includes the following:

- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-280-263-23, 72-60-00, para 1.D. and 2.F.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A. Lubrication System Servicing), and flush aircraft oil lines and oil cooler.
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (TM 55-1520-248-23, Task 1-4-5.1).

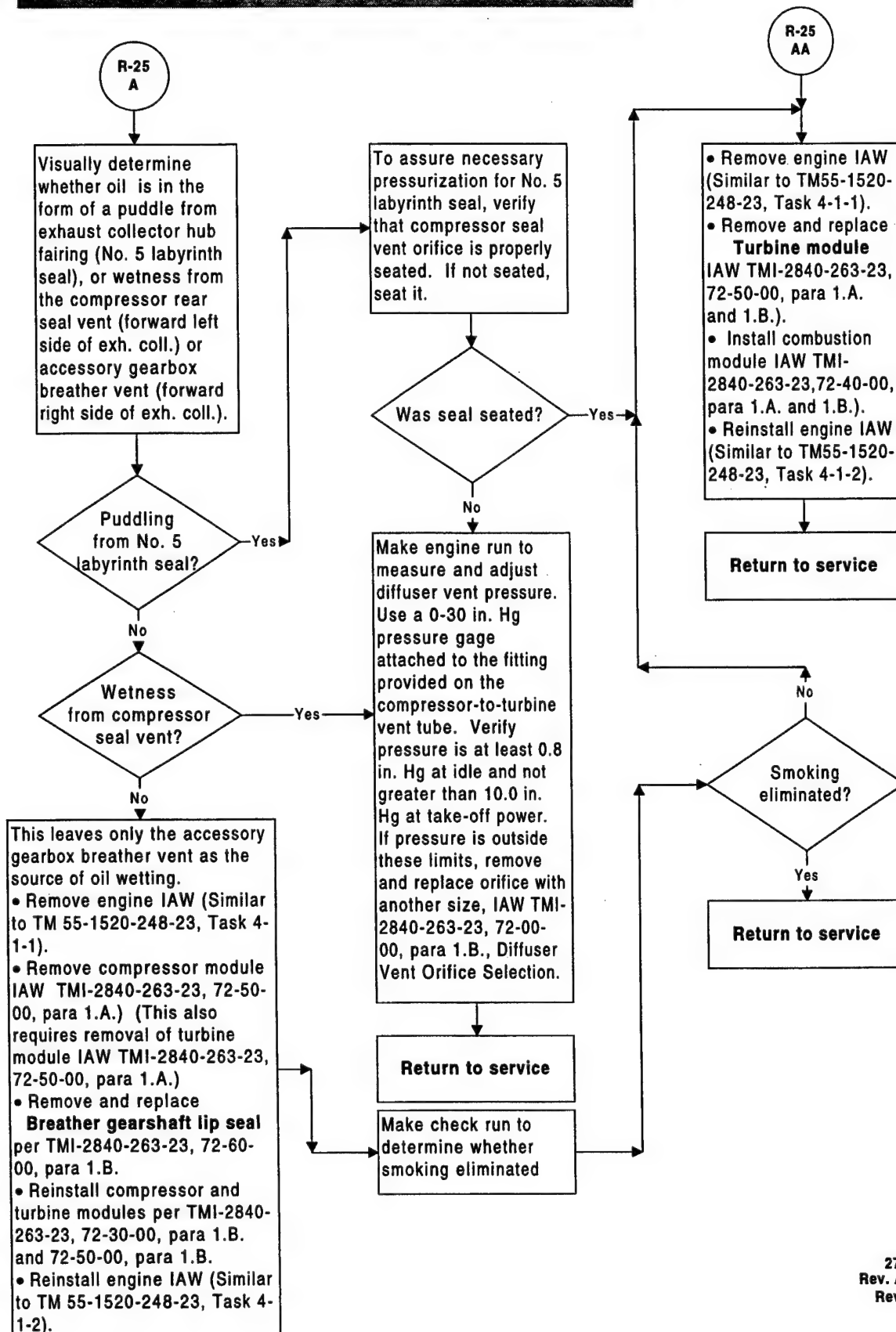
As a part of the check runs accompanying engine installation Task 4-1-2, check diffuser vent pressure. Use a 0-30 in. Hg pressure gage attached to the fitting provided on the compressor-to-turbine vent tube. Verify pressure is at least 0.8 in. Hg at idle and not greater than 10.0 in. Hg at takeoff power. If pressure is outside these limits, remove, and replace orifice with another size, IAW TMI-263-23, 72-00-00, para 1.B., Diffuser Vent Orifice Selection.

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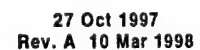


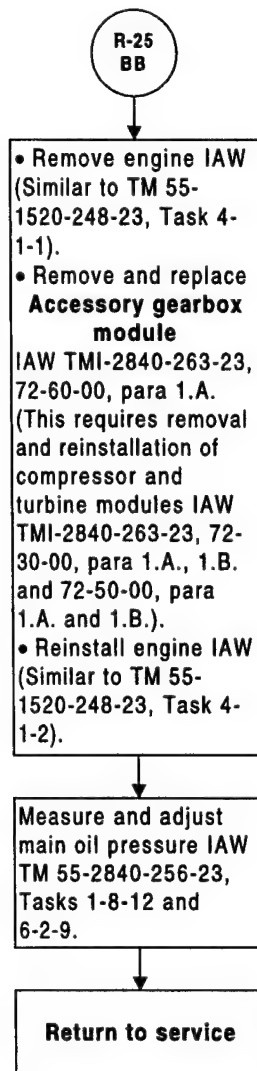
## R-25. Smoking During Steady State Operation

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## R-26. Smoking During Transients

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During deceleration, a brief puff of smoke is not abnormal, but a prolonged plume existing for most or all of the deceleration is cause for corrective action. Among the causes of smoking on deceleration are:

- Exhaust collector drain blocked
- Blocked power turbine scavenge strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenge flow from turbine
- Restricted scavenge flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

Inspect the turbine exhaust collector for wetness, oil puddling, and drain blockage.

Oil in exhaust collector?

Yes

Exh. coll. drain or tubing obstructed?

Yes

Correct obstruction and make check run to verify smoking eliminated

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.

- Remove power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine pressure oil fitting, screen, and nozzle.
- Install power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine scavenge oil strut.
- Remove and service scavenge oil sump.
- Measure oil flow from power turbine scavenge oil strut.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

Oil system scavenge flow check OK?

Yes

No

Return to service

Smoking eliminated?

Yes

No

R-26 A (Pg 2)

Make check run to determine whether smoking eliminated.

Smoking eliminated?

No

Yes

R-26 B (Pg 2)

Return to service

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

Make check run to determine whether smoking eliminated.

Smoking eliminated?

No

Yes

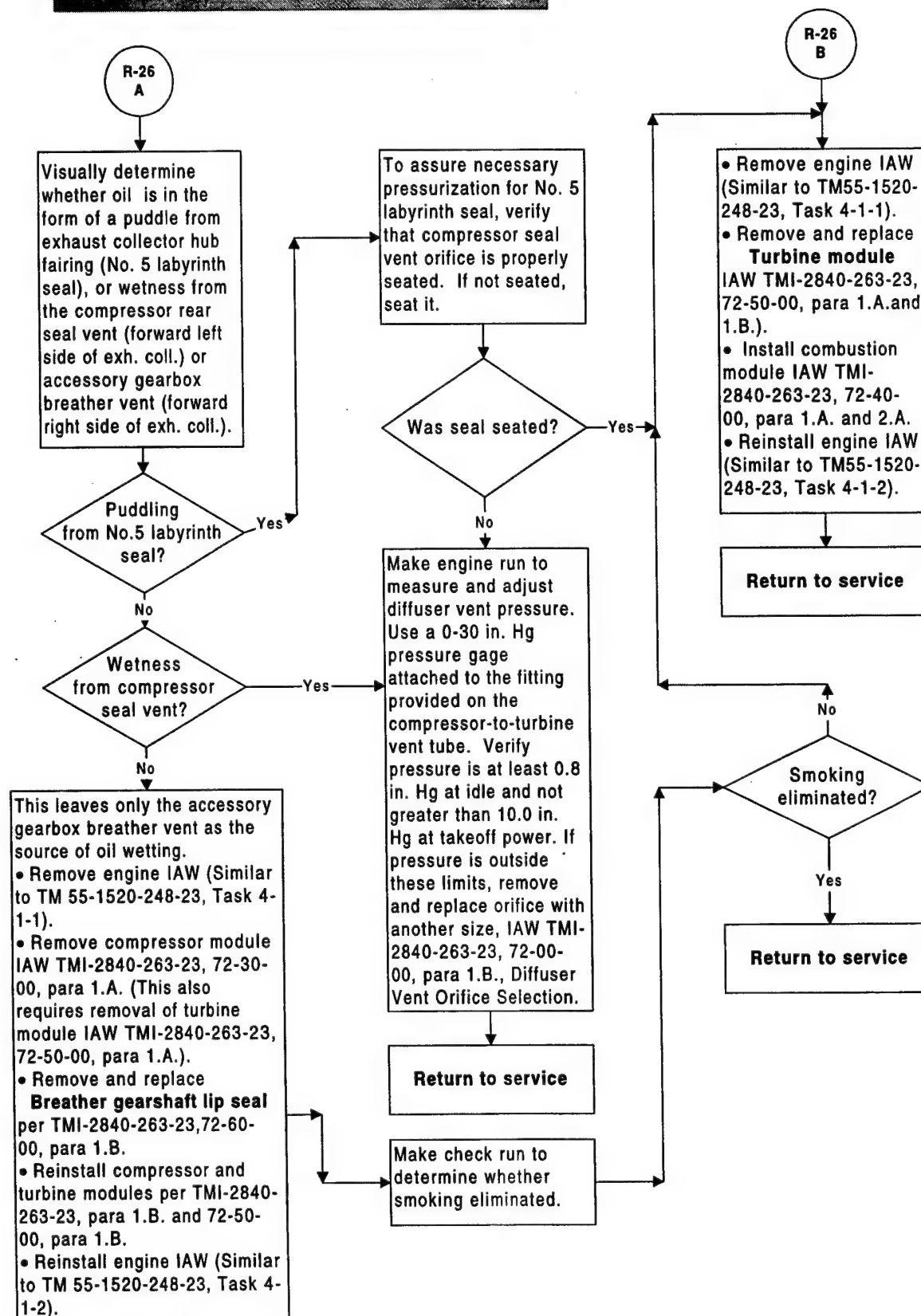
R-26 C (Pg 3)

Return to service

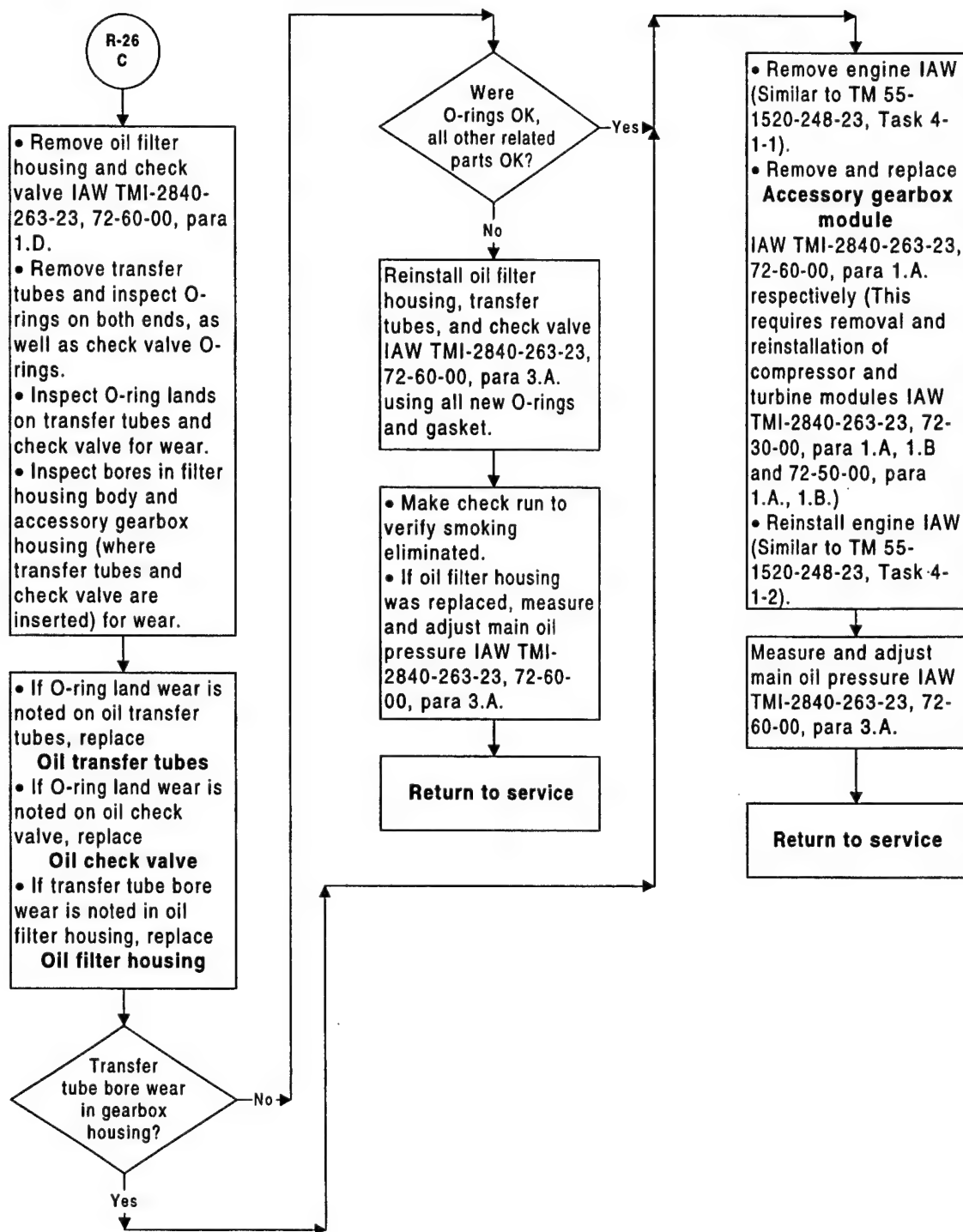
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## R-26. Smoking During Transients

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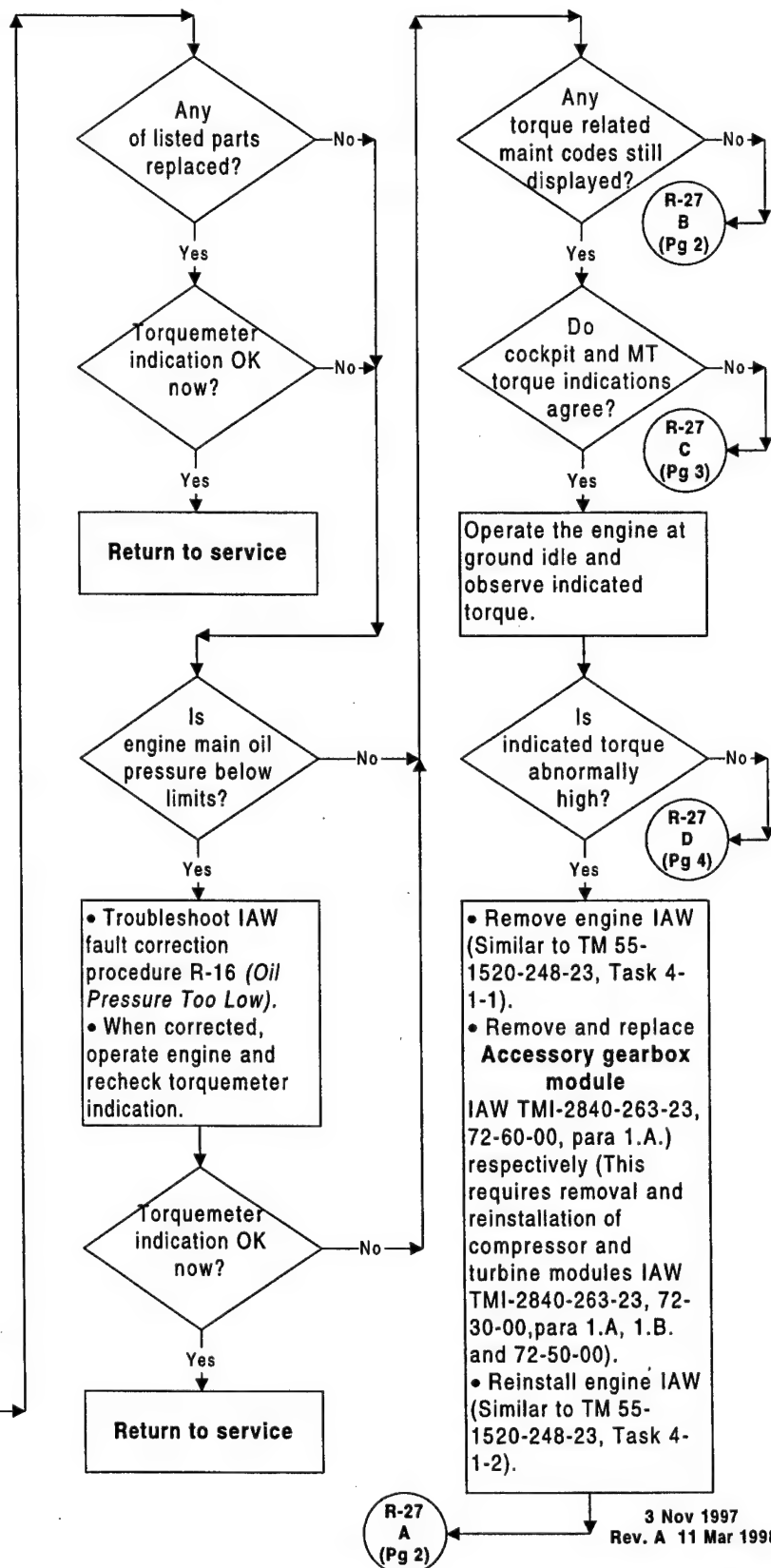
Faulty engine torquemeter indication can be of several kinds -- for example: an erroneous cockpit instrumentation indication; a problem with FADEC torque measurement; or a faulty engine pressure signal to both the cockpit system and the FADEC. A FADEC-related torque problem will probably result in a **FADEC Degrade Advisory** and subsequent **MAINTENANCE FAULT** messages accessible through the MFD or the Maintenance Terminal. Problems with the cockpit indication system usually rely on the pilot for recognition.

Causes of faulty torquemeter indication include the following:

- Aircraft or FADEC torquemeter pressure transducer fault
- Aircraft torque indicator fault
- Aircraft wiring fault between transducer and indicator
- Engine harness or interface harness between transducer and ECU
- Obstruction in tubing between engine and aircraft or FADEC torquemeter pressure transducer
- Low engine main oil pressure
- Faulty engine torquemeter
- ECU

If torque indication problems are encountered, connect the Maintenance Terminal (MT) and determine whether FADEC faults are indicated. If so, perform maintenance actions to clear. If, as a result of a fault indication(s), any of the following were replaced, perform an engine check run and determine whether the torquemeter indication problem still exists:

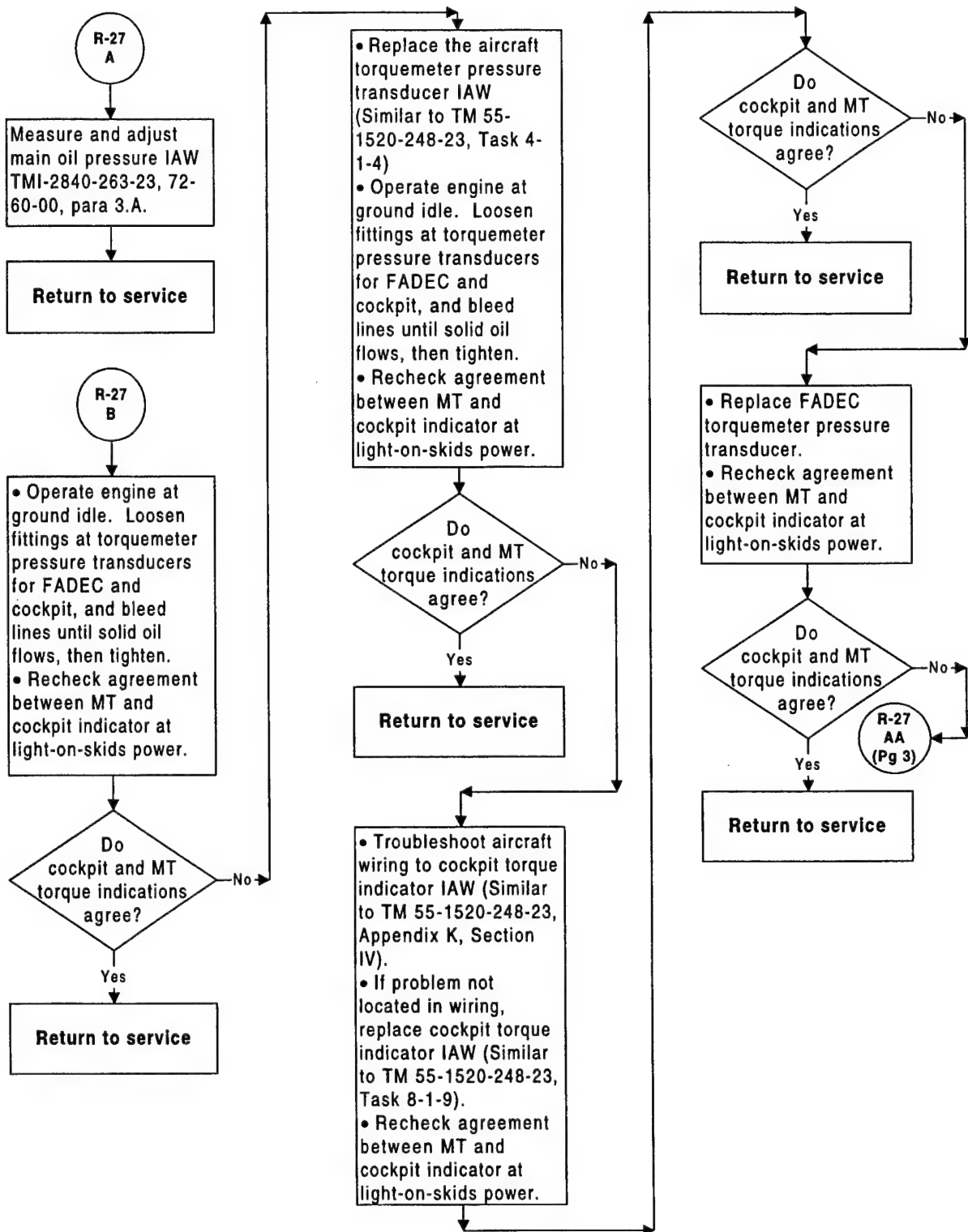
- ECU
- Engine Electrical Harness
- Engine Interface Harness
- Engine Torquemeter Pressure Transducer



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## R-27. Faulty Torquemeter Indication

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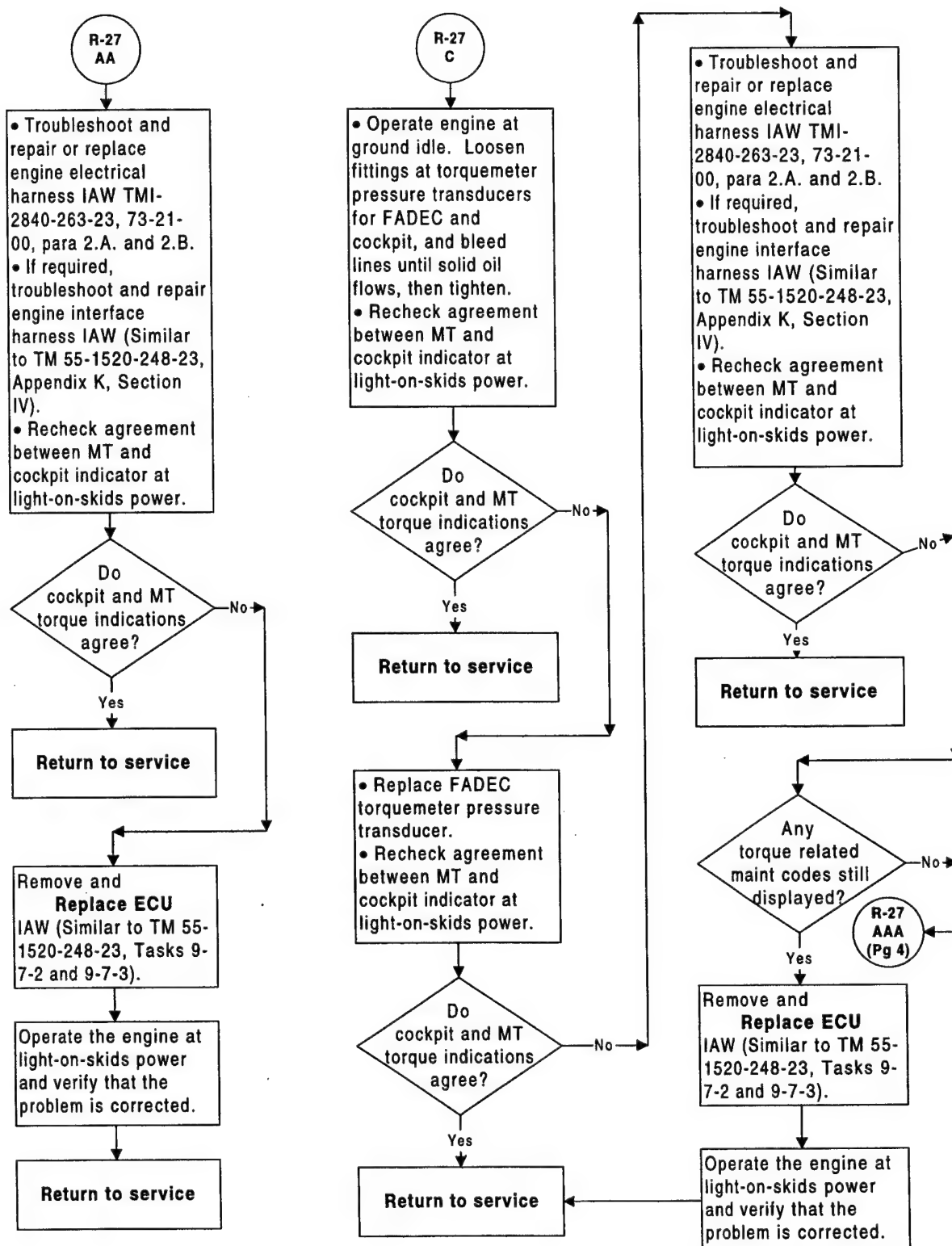


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## R-27. Faulty Torquemeter Indication

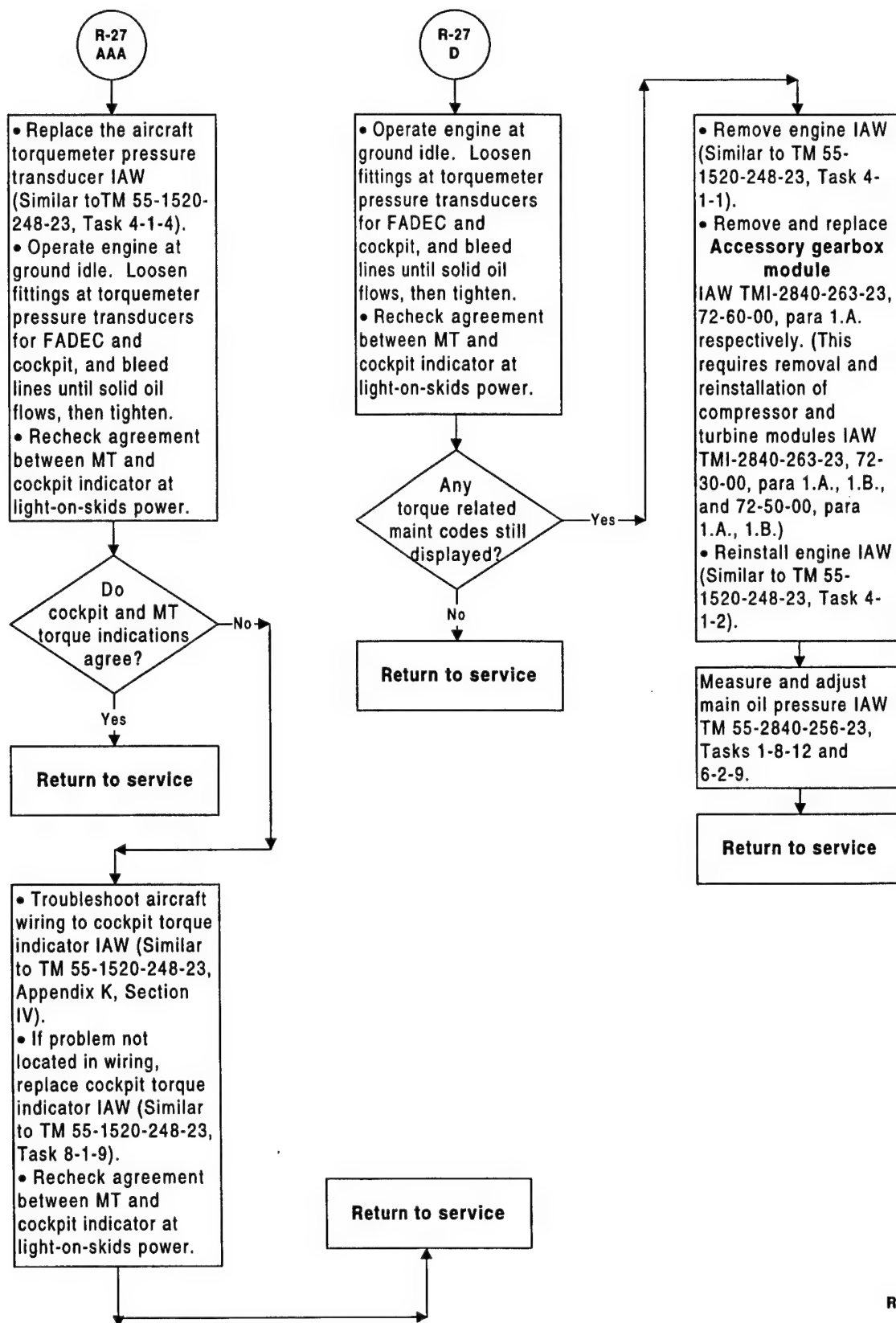
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## R-27. Faulty Torquemeter Indication

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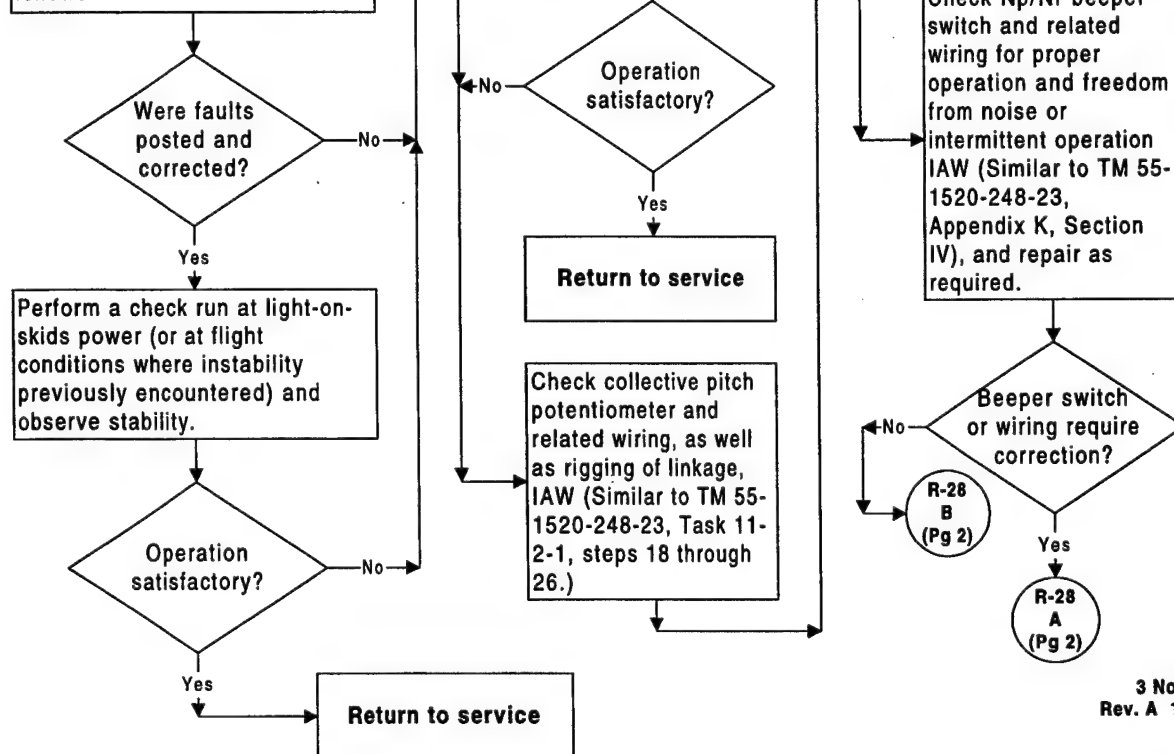
# **R-28. Unstable In Power Turbine Governing (95% - 105% Np)**

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Engine instability in the Power Turbine Governing mode of operation (throttle angle at or above 92°, Np at 95% to 105%) may be caused by:

- Loose throttle linkage
- Faulty collective pitch position potentiometer or linkage
- Np/Nr beeper switch
- Restricted fuel supply
- Engine harness, interface harness or aircraft harness to ECU
- ECU fault
- HMU fault

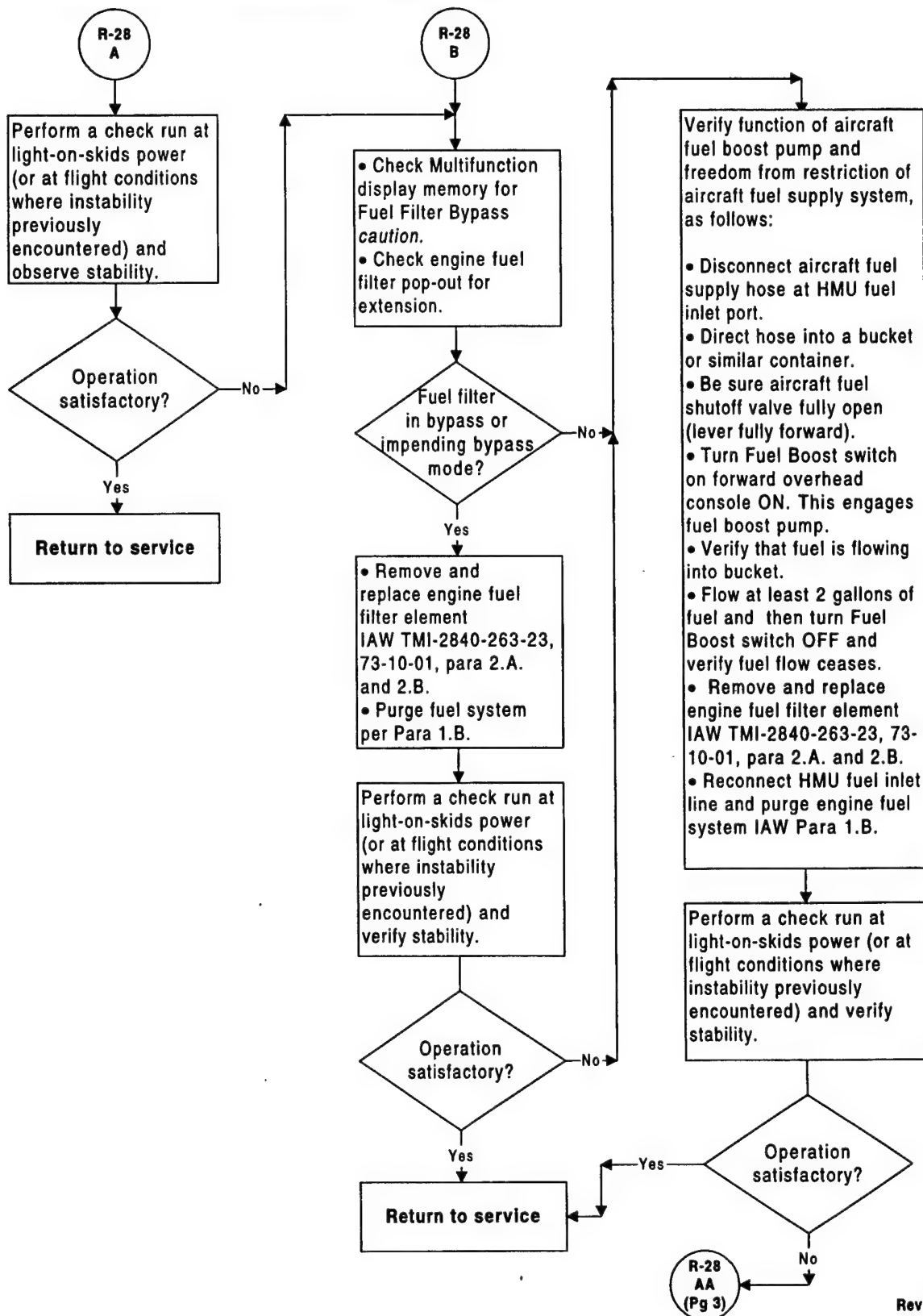
This condition may generate a **FADEC Fail Warning** or **FADEC DEGRADE Advisory** on the MFD and produce related **MAINTENANCE FAULT** messages on the Maintenance Terminal (MT). When encountered, connect the Maintenance Terminal and read out Current and Last Run faults. Perform necessary maintenance to clear faults, then proceed as follows:



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# **R-28. Unstable In Power Turbine Governing (95% - 105% Np)**

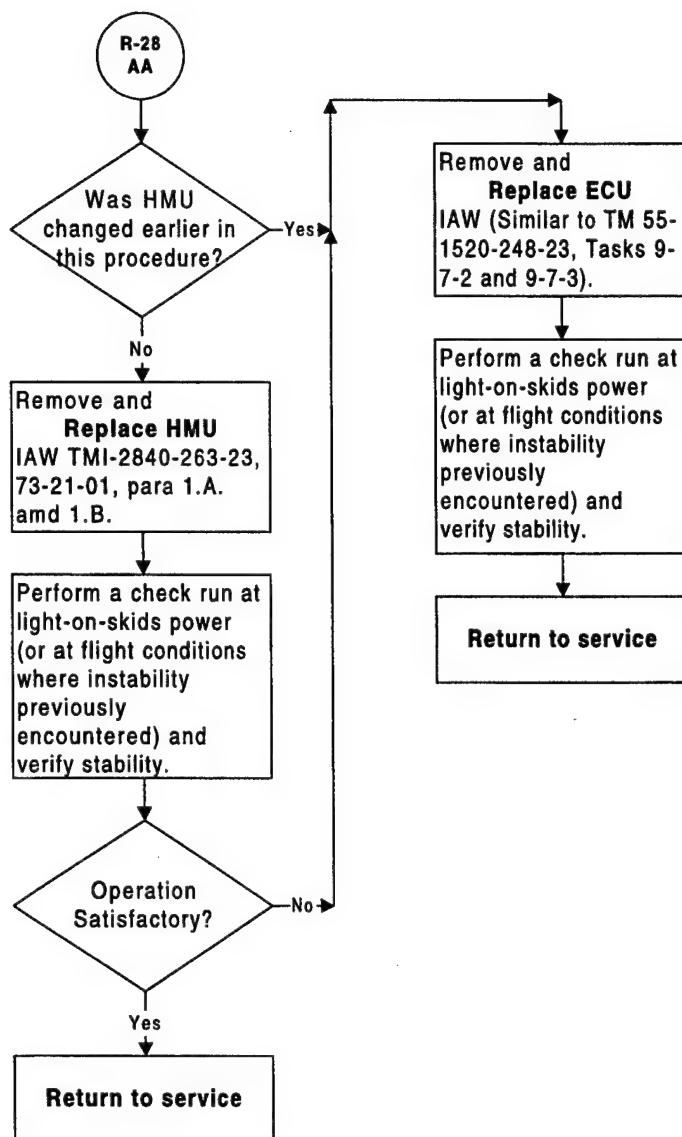
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**R-28. Unstable In Power Turbine  
Governing (95% - 105% Np)**

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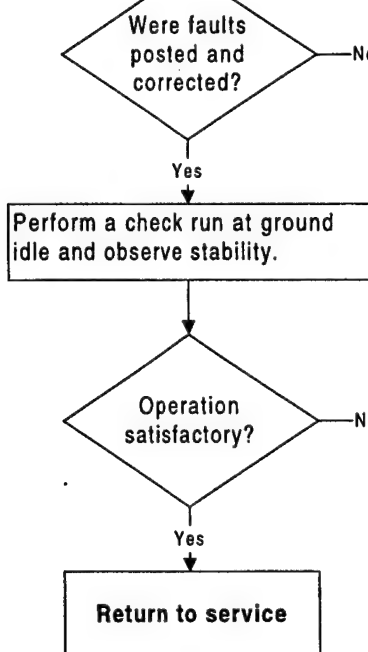
# R-29. Unstable At Ground Idle

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Engine instability at Ground Idle (PLA at 30° to 40°, Ng at 64%) may be caused by:

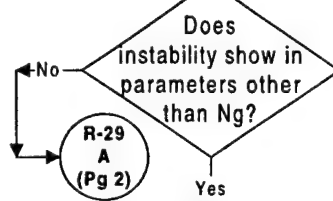
- Loose throttle linkage
- Restricted fuel supply
- Engine Electrical Harness, Interface Harness or aircraft wiring to ECU
- Intermittant Ng speed pick-up or cockpit Np indicator
- ECU fault
- HMU fault

This condition may generate a **FADEC Fail Warning** or **FADEC DEGRADE Advisory** on the MFD and produce related **MAINTENANCE FAULT** messages on the Maintenance Terminal (MT). When encountered, connect the Maintenance Terminal and read out Current and Last Run faults. Perform necessary maintenance to clear faults, then proceed as follows:



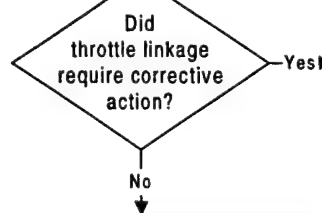
Set MT to the Real Time Data -- Analog Parameters page.

- During unstable operation at ground idle, observe cockpit displays of Ng, Np, Torque, and MGT.
- Also observe MT displays of the same parameters.

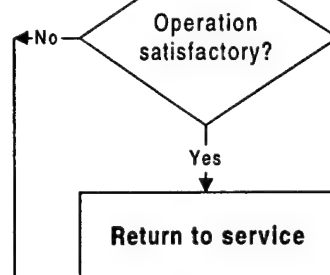


This indicates instability is real.

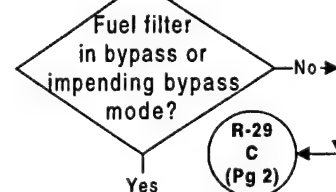
- Inspect throttle linkage, from twist grip to HMU input spindle, for security and freedom from slack or looseness.
- Verify rigging IAW TMI-2840-263-23, 73-21-01, para 1.D.
- Make corrections as required.



Perform a check run at ground idle and observe stability.



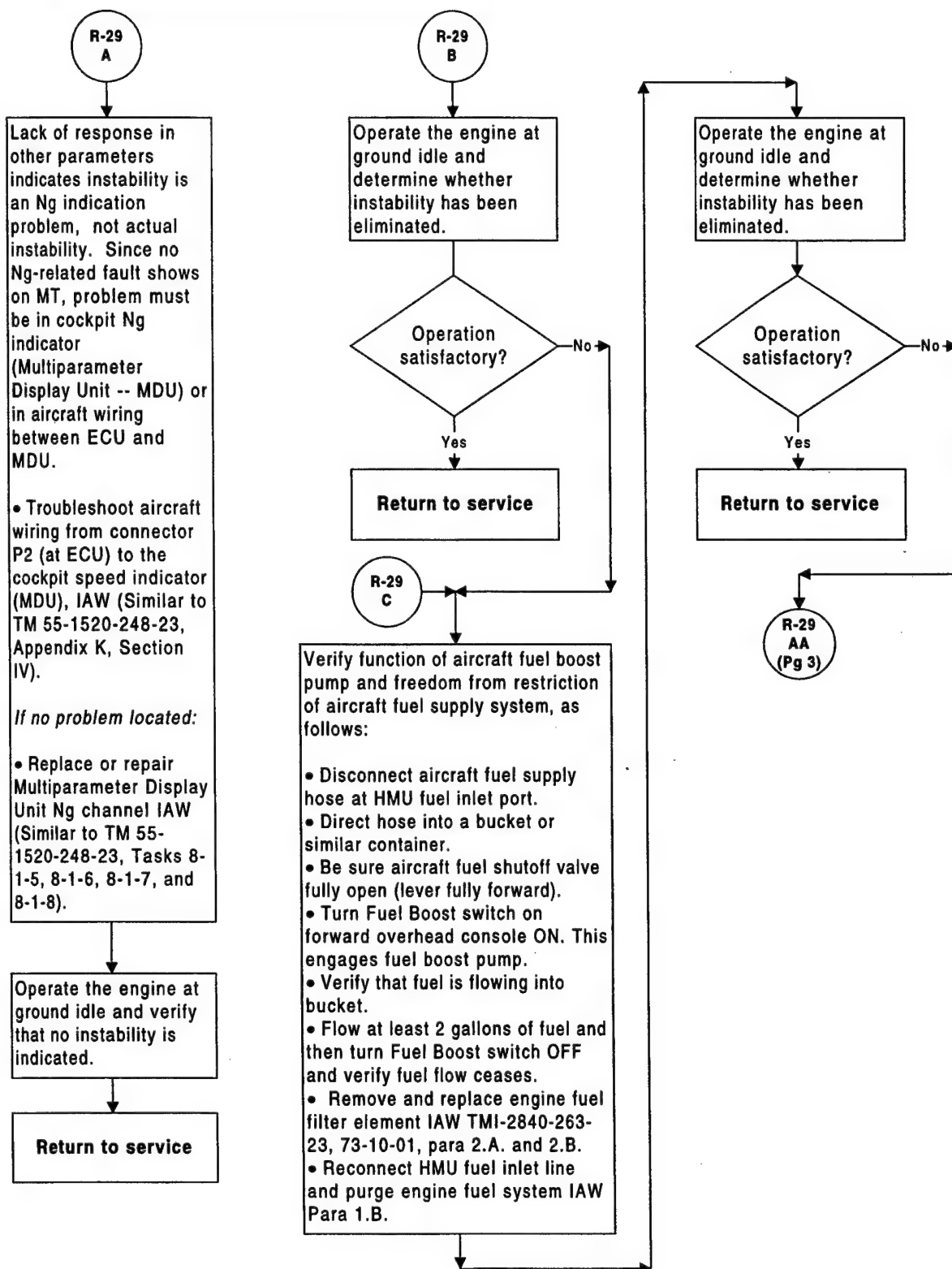
- Check Multifunction display memory for Fuel Filter Bypass caution.
- Check engine fuel filter pop-out for extension.



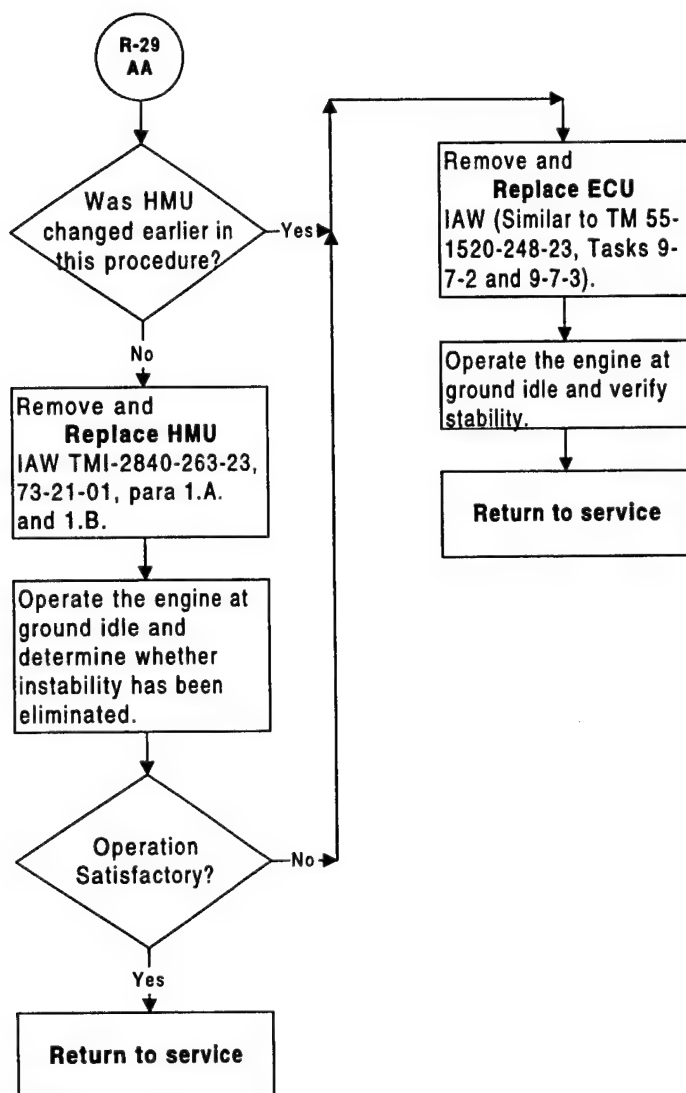
- Remove and replace engine fuel filter element IAW TMI-2840-263-23, 73-10-01, para 2.A. and 2.B.
- Purge fuel system per Para 1.B.



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## R-30. Excessive Vibration

Engine vibration can occur as the result of many factors, the primary ones of which are listed below:

- Loose engine mounts
- Accessory unbalance
- Engine rotor system unbalance (gas generator or power turbine)
- Gear tooth mesh
- Gear unbalance
- Bearing failure
- Response to aircraft rotor system, or to drive system unbalance or alignment

The presence of vibration is sometimes difficult to detect by touch or sound (depending upon frequency and amplitude) but it makes itself known by unusual wear and fretting of external parts and equipment, loosening of nuts, bolts, fasteners, and fittings, etc.

If the existence of higher than normal vibration is known or suspected, take the following actions.

Check the engine mounts for looseness (accessory gearbox side and bottom mounts and turbine mount), and tighten as required (Similar to Ref. TM 55-1520-248-23, Task 4-7-1).

Were mounts loose?

Yes

No

Torque mounts and conduct vibration check IAW TM 1-2840-263-23 72-00-00 Para 2.A.

Use a vibration analyzer such as a Chadwick-Helmuth Model 192 with Model 7570 High Temperature Accelerometers. Other equipment may also be used.

Does vibration still exist?

No

Return to service

Yes

Conduct vibration check IAW TMI-2840-263-23 72-00-00 Para 2A to verify engine caused vibration.

Is vibration engine caused?

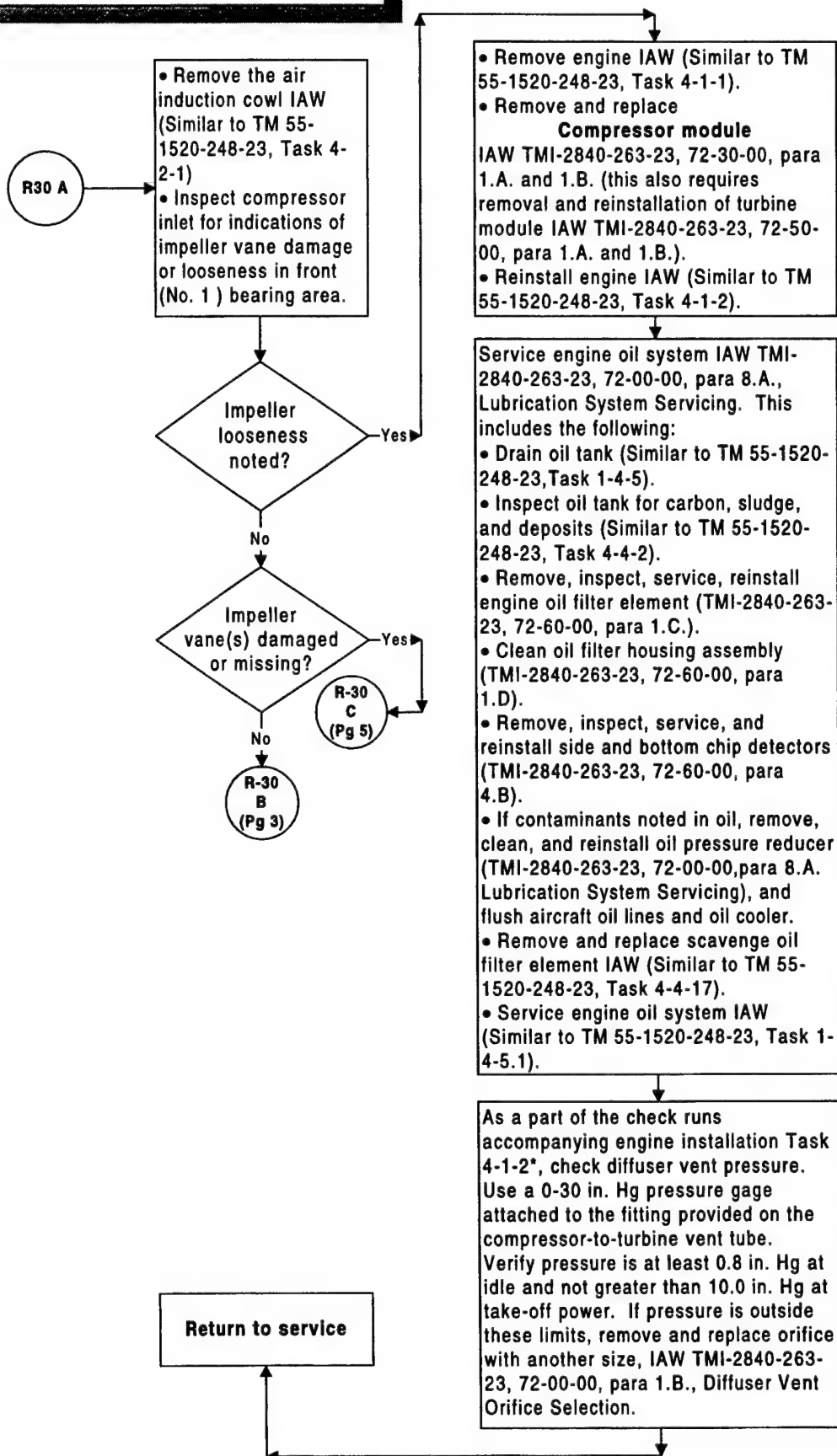
No

Refer to applicable aircraft troubleshooting porcedures.

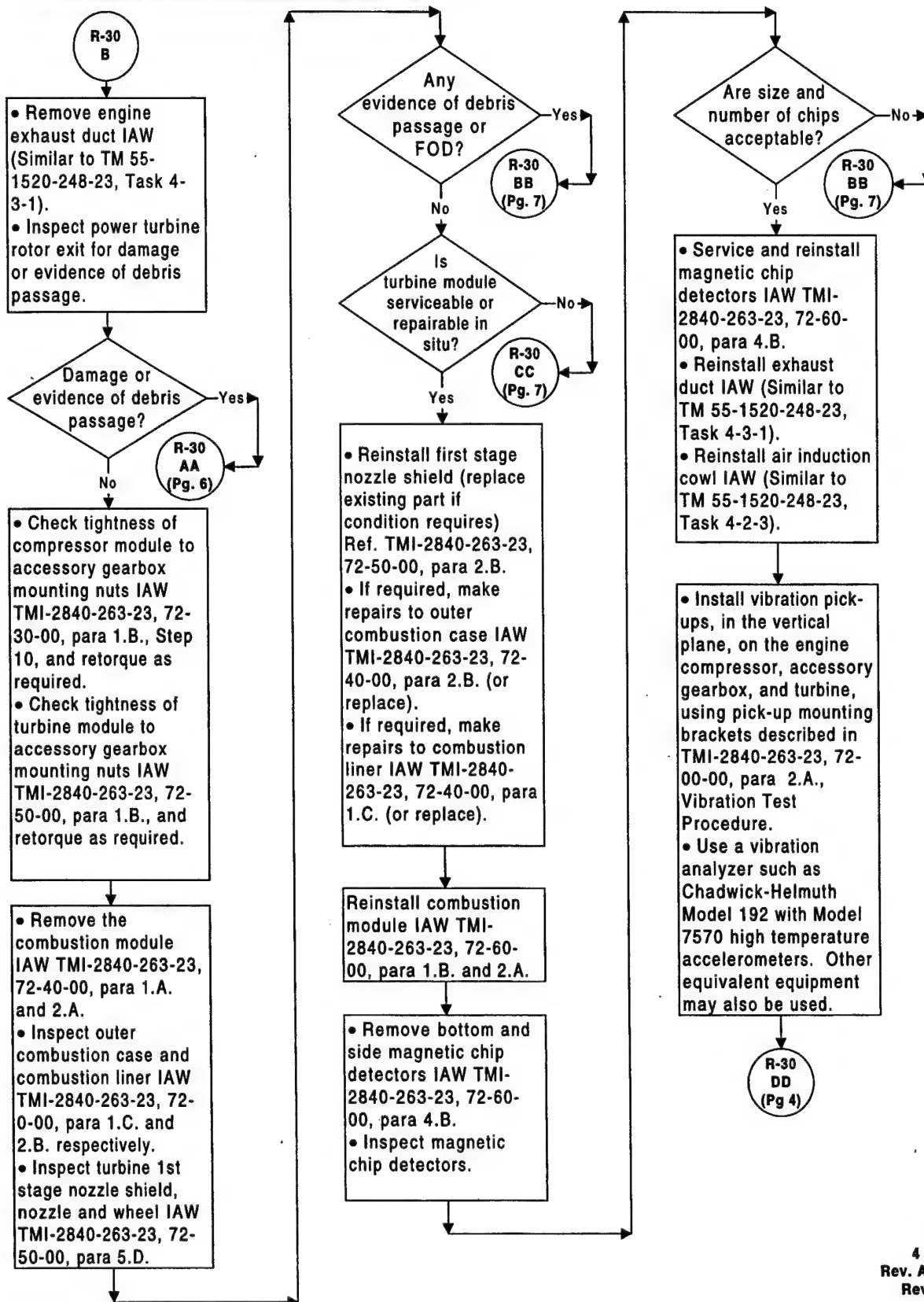
R30 A  
pg 2

## R-30. Excessive Vibration

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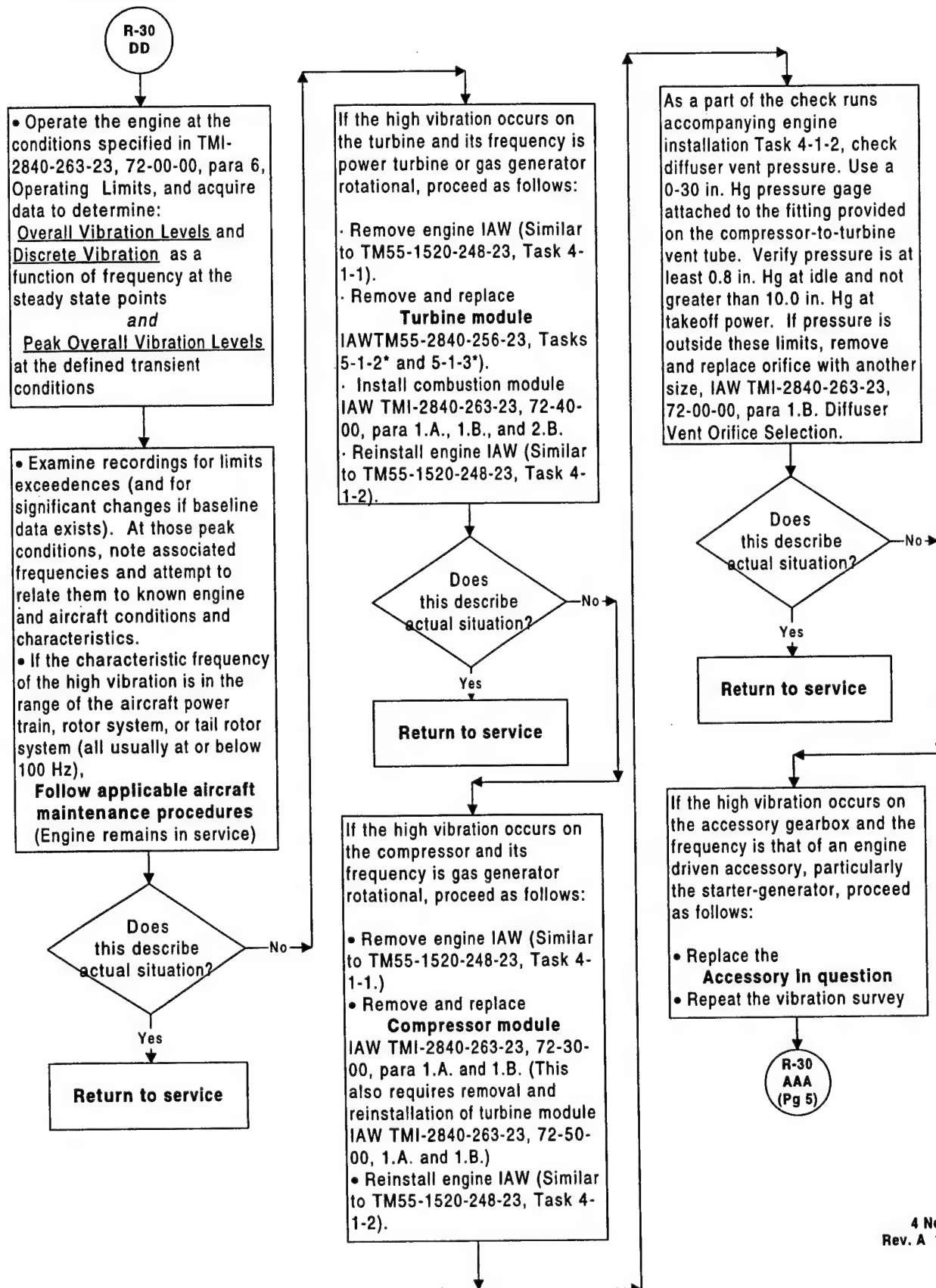


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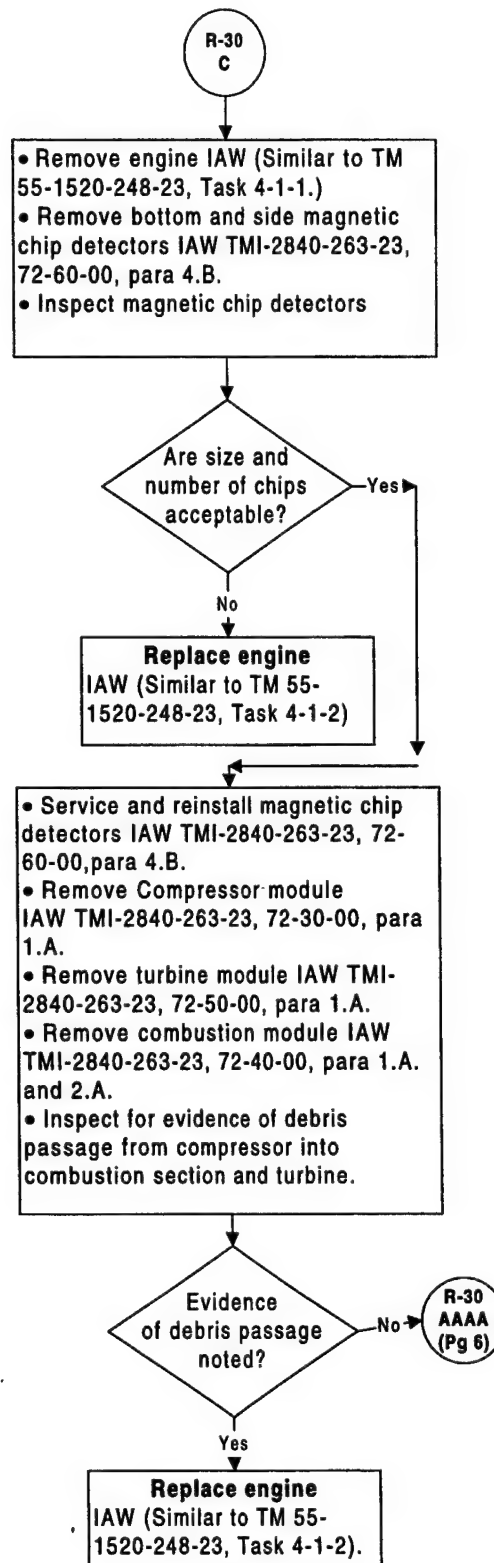


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Rev. 12 Jul 99

## R-30. Excessive Vibration

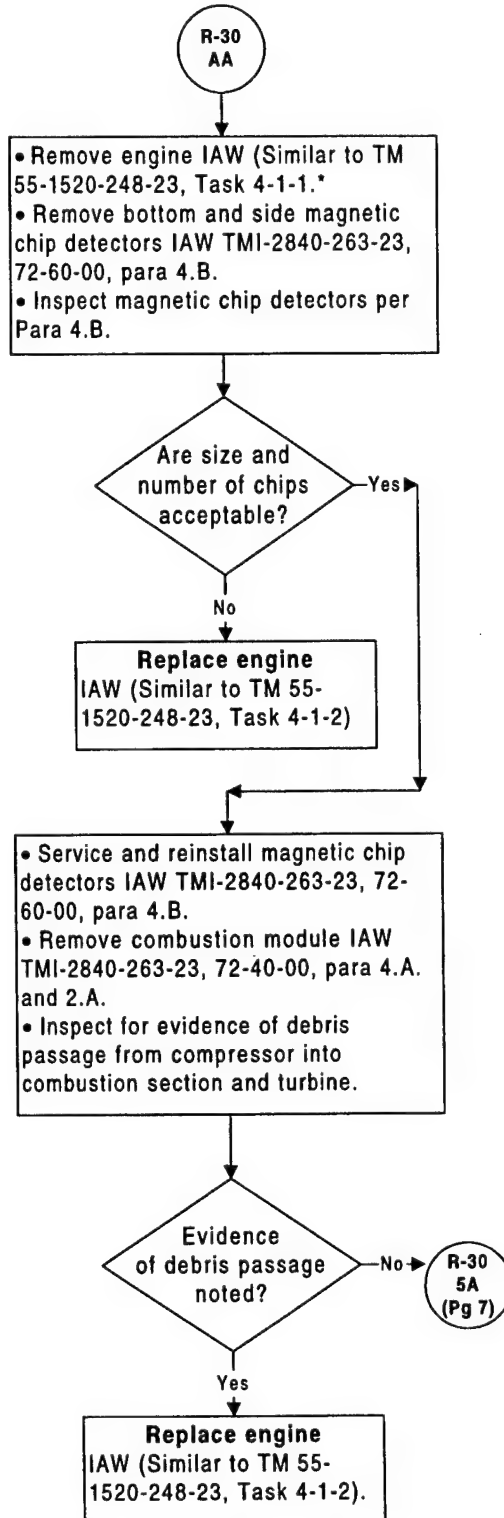
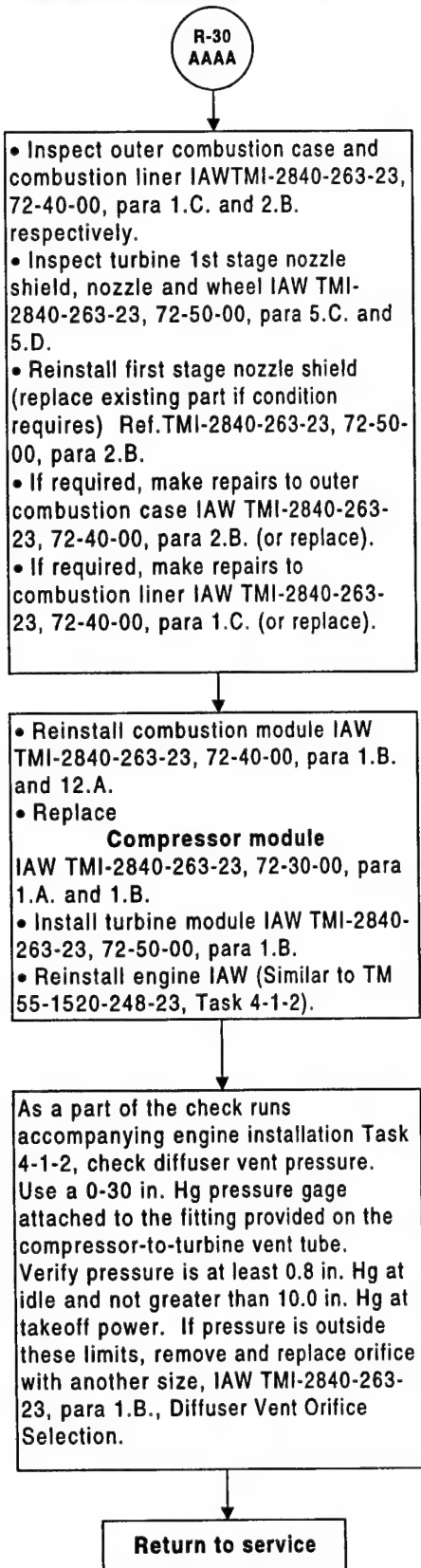


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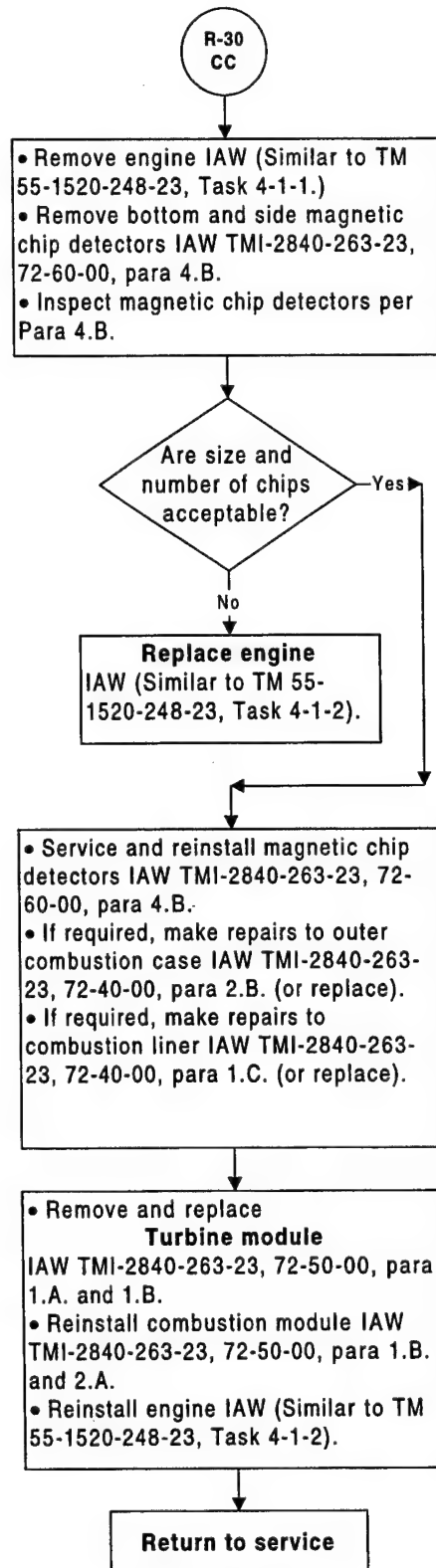
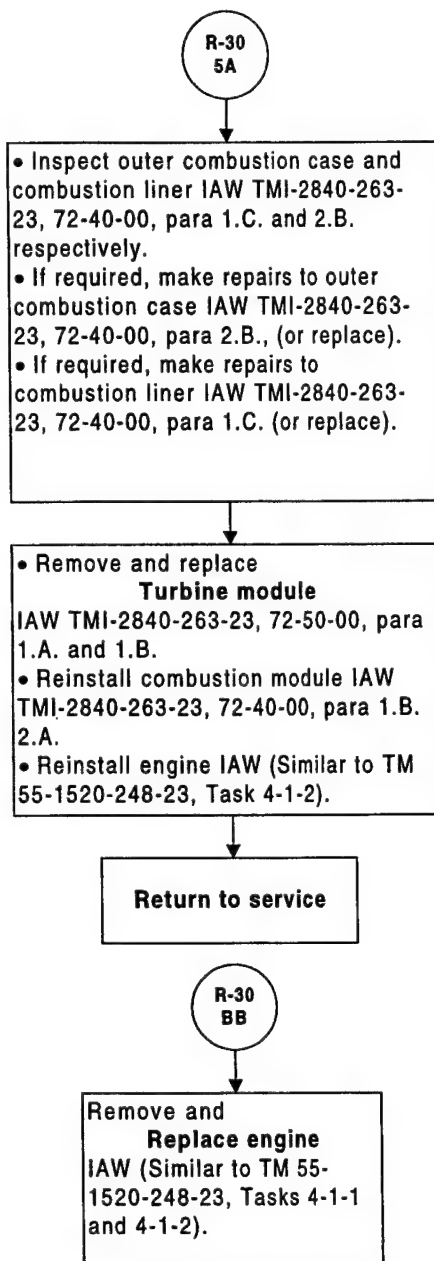


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## R-30. Excessive Vibration



## R-30. Excessive Vibration



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# SD-1. Afterfire (Rising MGT After Shutdown)

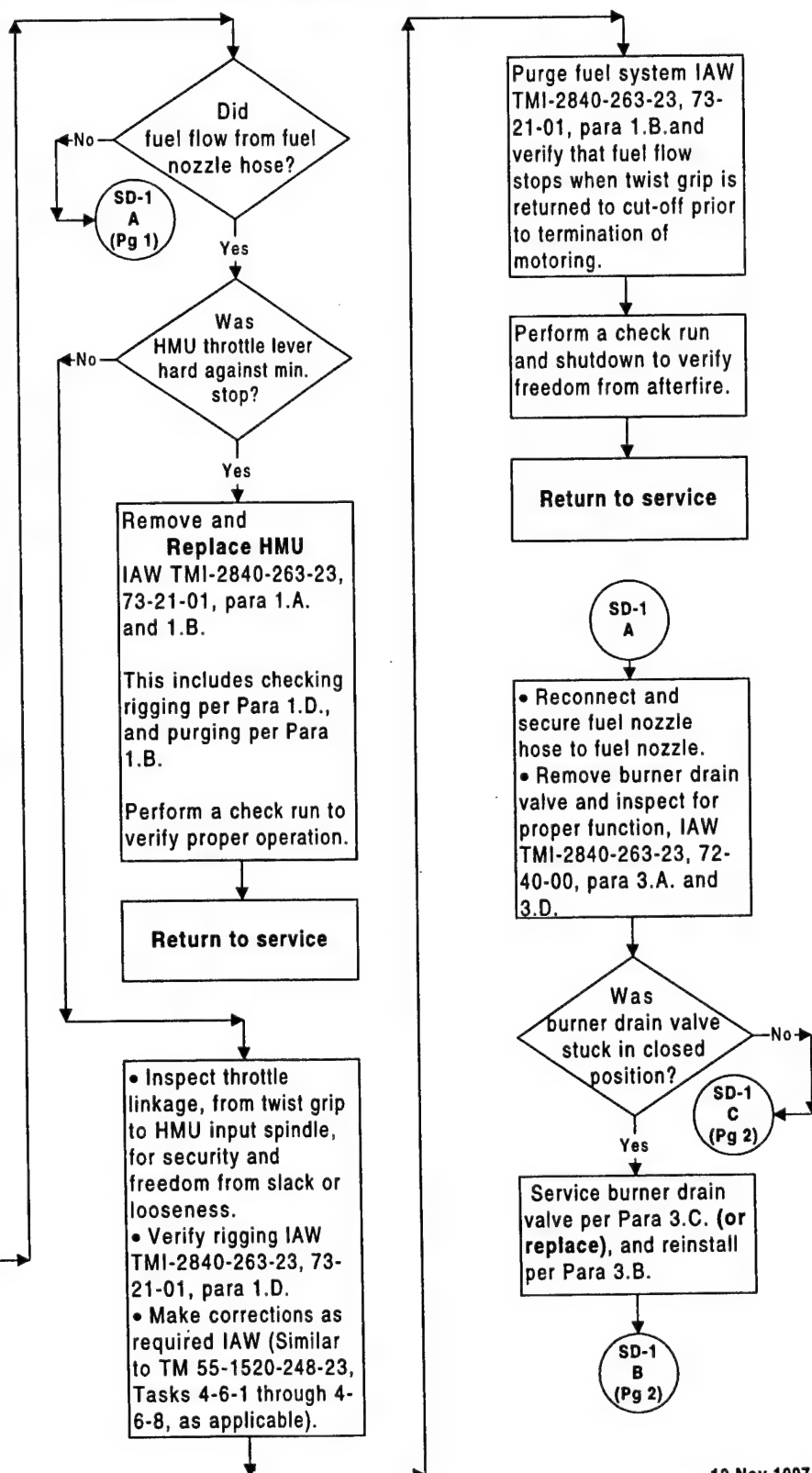
Page 1 of 2

Shutdown afterfires, which are indicated by rising MGT after cessation of Ng rotation, are usually the result of fuel leaking past the HMU cut-off valve, or of internal oil leakage in the turbine section of the engine.

If an afterfire is encountered, use the following sequence to isolate and correct the fault.

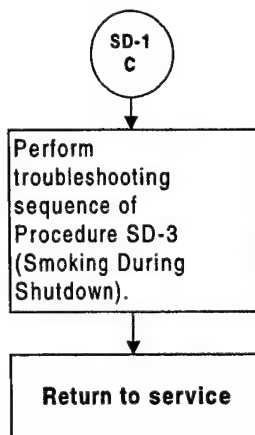
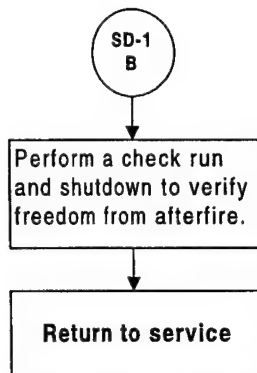
**Afterfires can cause damage to the gas generator turbine that could result in failure. Follow the sequence as specified.**

- After the fire is extinguished and MGT has cooled below 150°C (302°F) -- **[do not motor engine to cool]** -- disconnect the fuel nozzle hose at the fuel nozzle end.
- Move the twist grip to cut-off position and observe whether the HMU throttle lever is hard against the minimum (0°) stop. **If not against the stop, do not adjust or rerig at this time.**
- Open the aircraft fuel shut-off valve.
- Direct the end of the fuel nozzle hose into a container, and motor the engine with the starter.
- With the twist grip in the cut-off position, observe whether fuel flows from the fuel nozzle hose during motoring.



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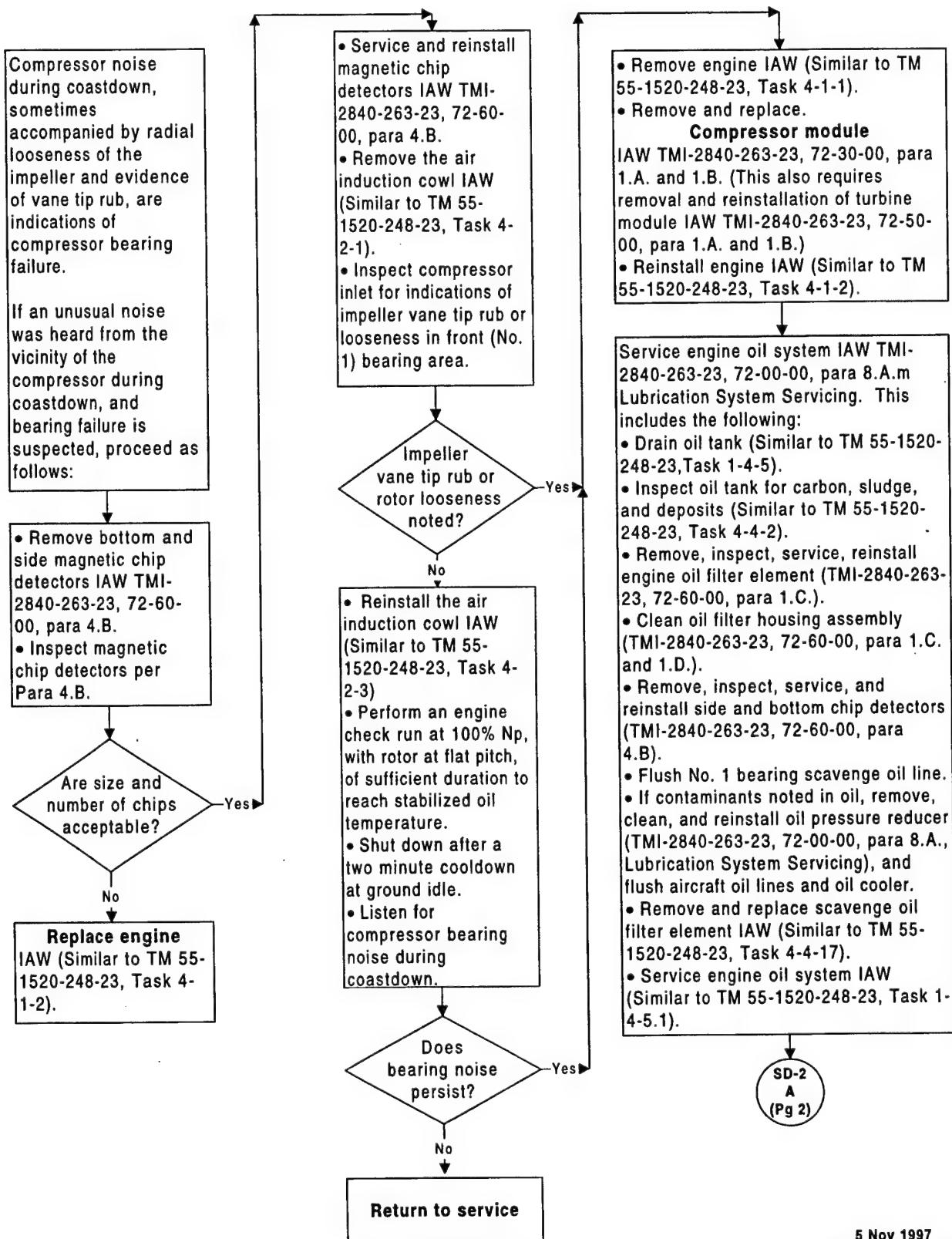


**SD-1. Afterfire (Rising MGT After Shutdown)**

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## SD-2. Compressor Bearing Noise Or Loose Compressor Rotor

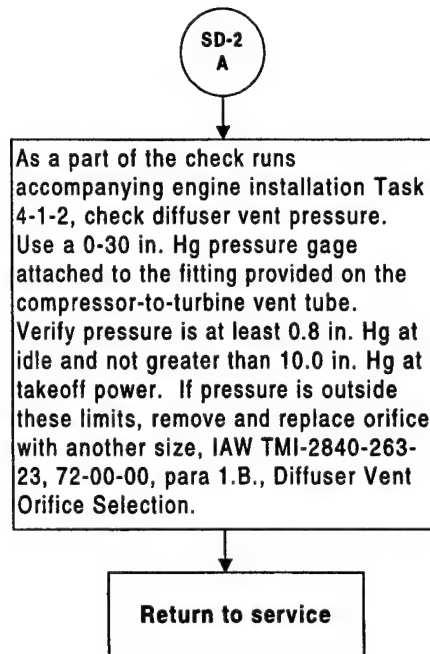
Page 1 of 2



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## SD-2. Compressor Bearing Noise Or Loose Compressor Rotor

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# SD-3. Smoking During Shutdown

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During coastdown, a brief puff of smoke is not abnormal, but a continuous plume is cause for corrective action. Among the causes of shutdown smoking are:

- Exhaust collector drain blocked
- Burner drain blocked
- Blocked power turbine scavenge strut
- Defective turbine seals
- Leaking No. 5 labyrinth seal
- Restricted scavenge flow from turbine
- Restricted scavenge flow in aircraft system
- Leaking oil transfer tubes or check valve
- Faulty oil pump

In the absence of evidence suggesting a specific cause, proceed as follows to identify and resolve the problem.

Inspect the turbine exhaust collector for wetness, oil puddling, and drain blockage.

Oil in exhaust collector?

Yes

Exh. coll. drain or tubing obstructed?

Yes

Correct obstruction and make check run to verify shutdown smoking eliminated.

Service power turbine support oil supply and scavenge details IAW following tasks of TMI-2840-263-23, 72-50-00, para 5.F.

- Remove power turbine pressure oil fitting, screen, and nozzle
- Service power turbine pressure oil fitting, screen, and nozzle.
- Install power turbine pressure oil fitting, screen, and nozzle.
- Service power turbine scavenge oil strut.
- Remove and service scavenge oil sump.
- Measure oil flow from power turbine scavenge oil strut.
- Install scavenge oil sump.
- Measure engine oil system scavenge oil flow.

Oil system scavenge flow check OK?

Yes

No

Return to service

Smoking eliminated?

Yes

Make check run to verify shutdown smoking eliminated.

Smoking eliminated?

No

Yes

Return to service

Inspect scavenge return components in aircraft system (piping, oil cooler, oil cooler bypass valve, scavenge filter, tank, etc.) for possible restrictions, dents, or kinks, and correct as applicable. Also check oil tank vent line. Replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).

Make check run to verify shutdown smoking eliminated.

Smoking eliminated?

No

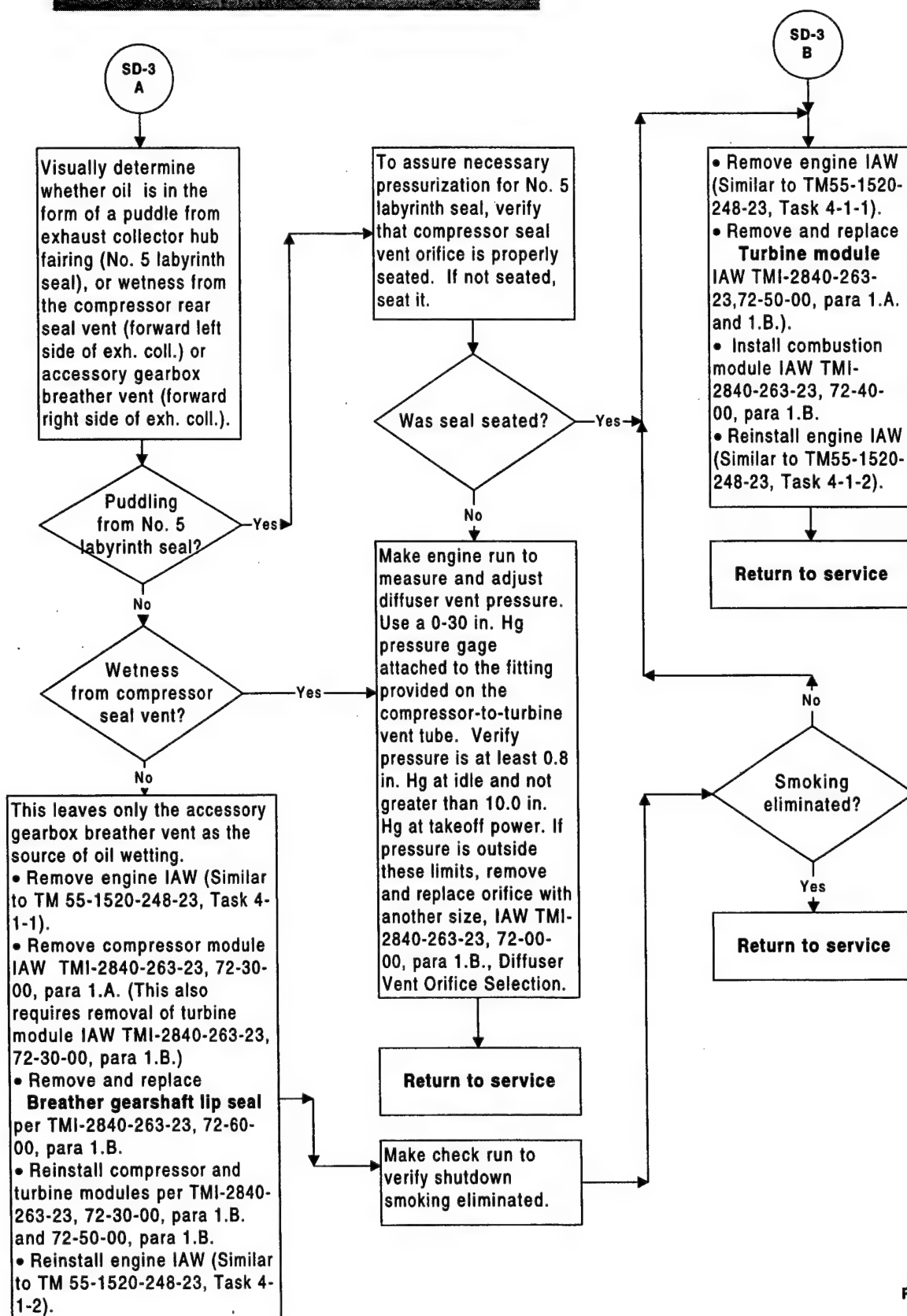
Yes

Return to service

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# SD-3. Smoking During Shutdown

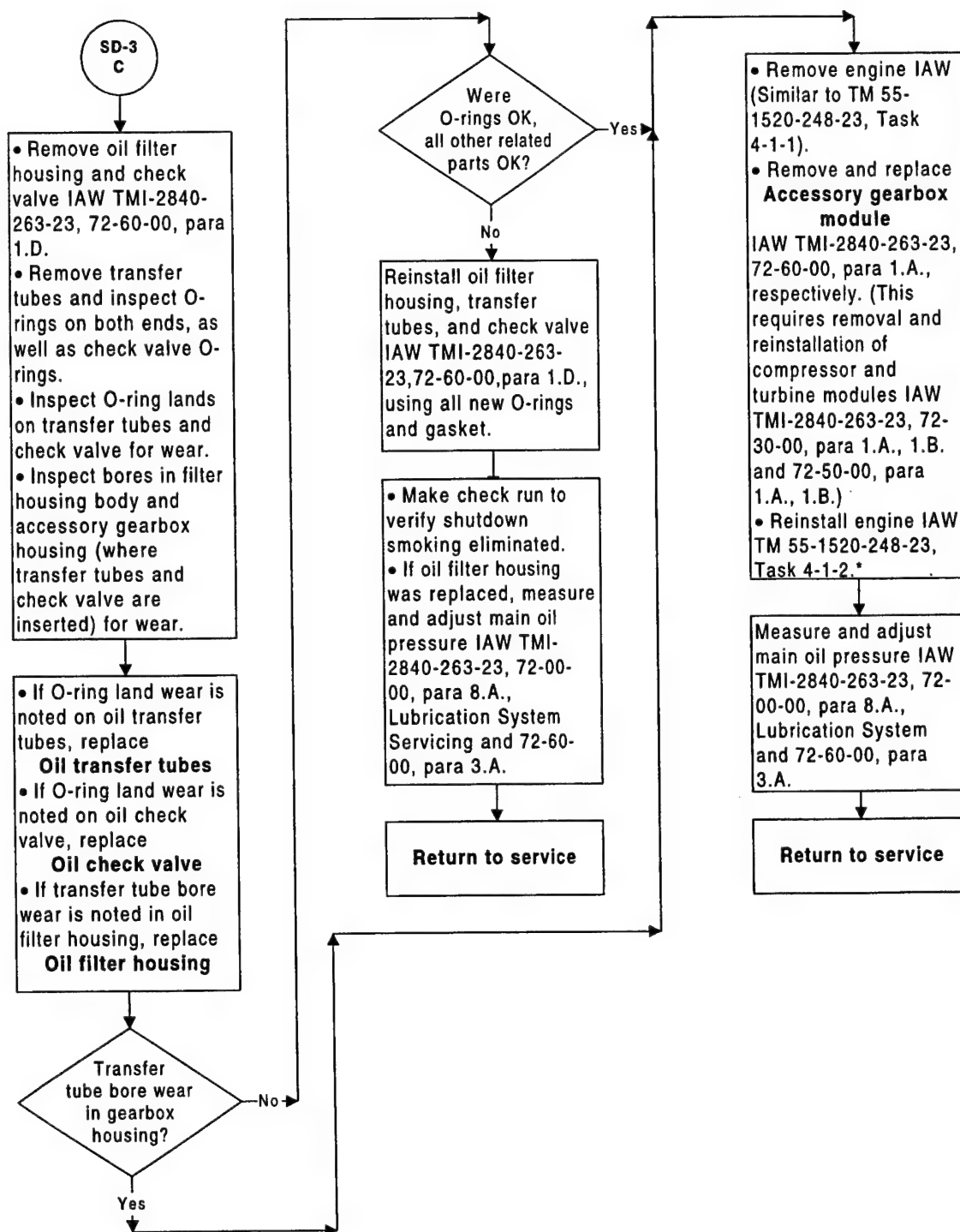
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## SD-3. Smoking During Shutdown

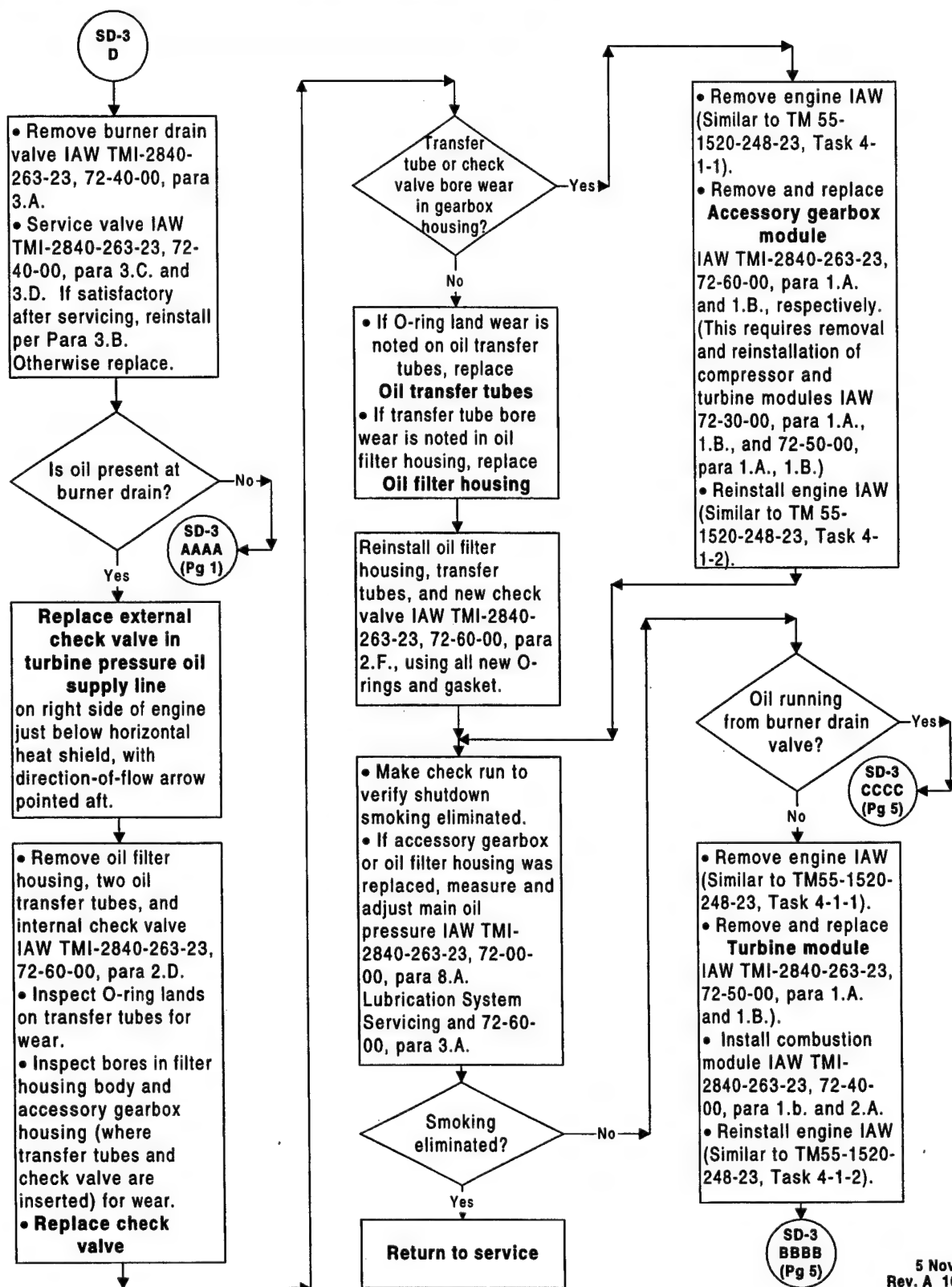
Page 3 of 6



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## SD-3. Smoking During Shutdown

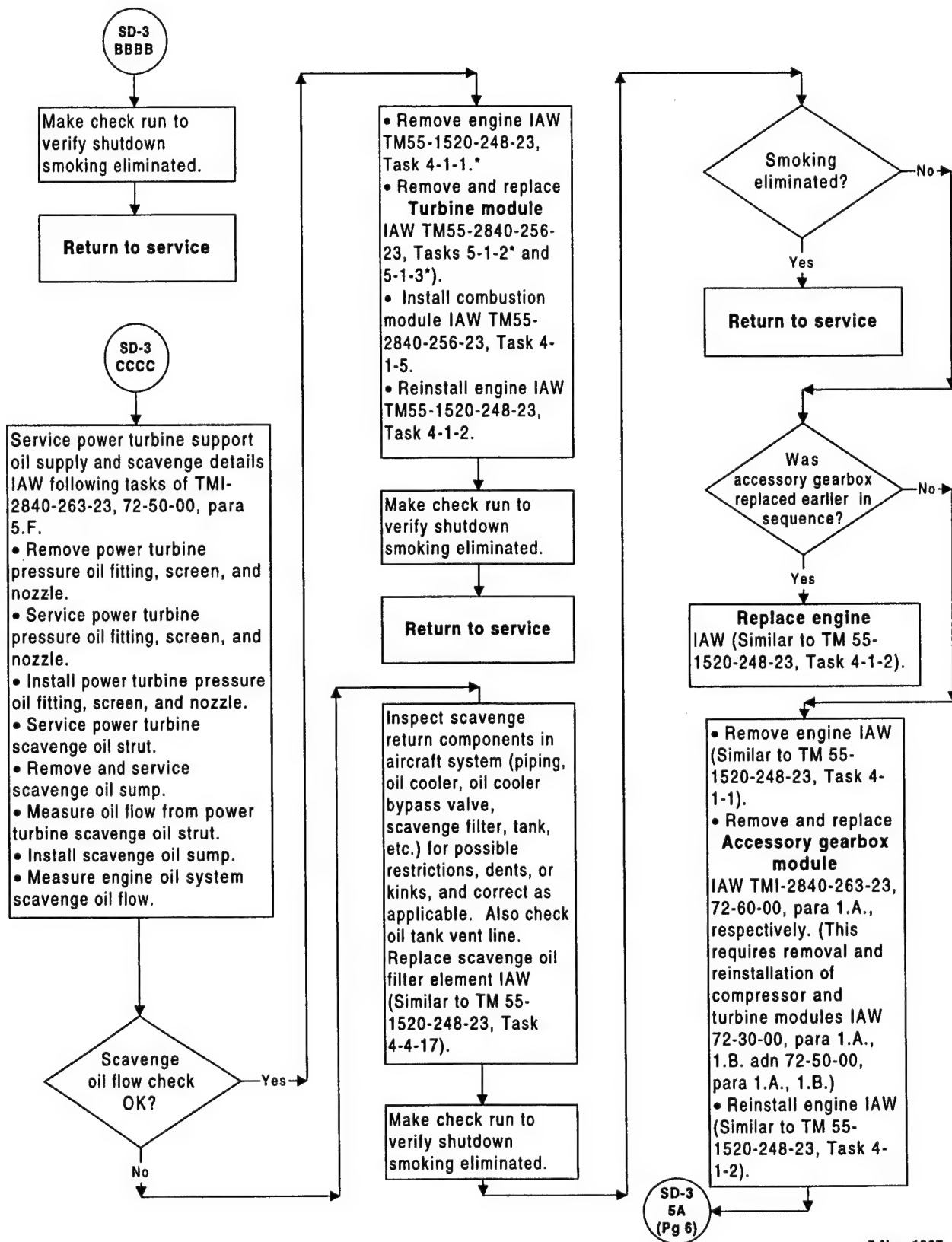
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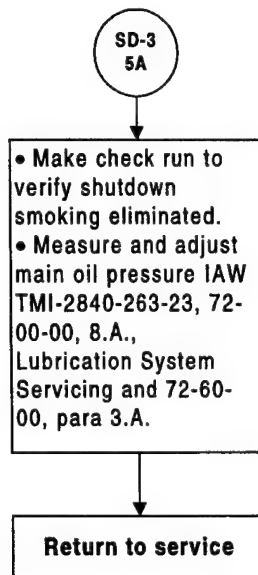
## SD-3. Smoking During Shutdown

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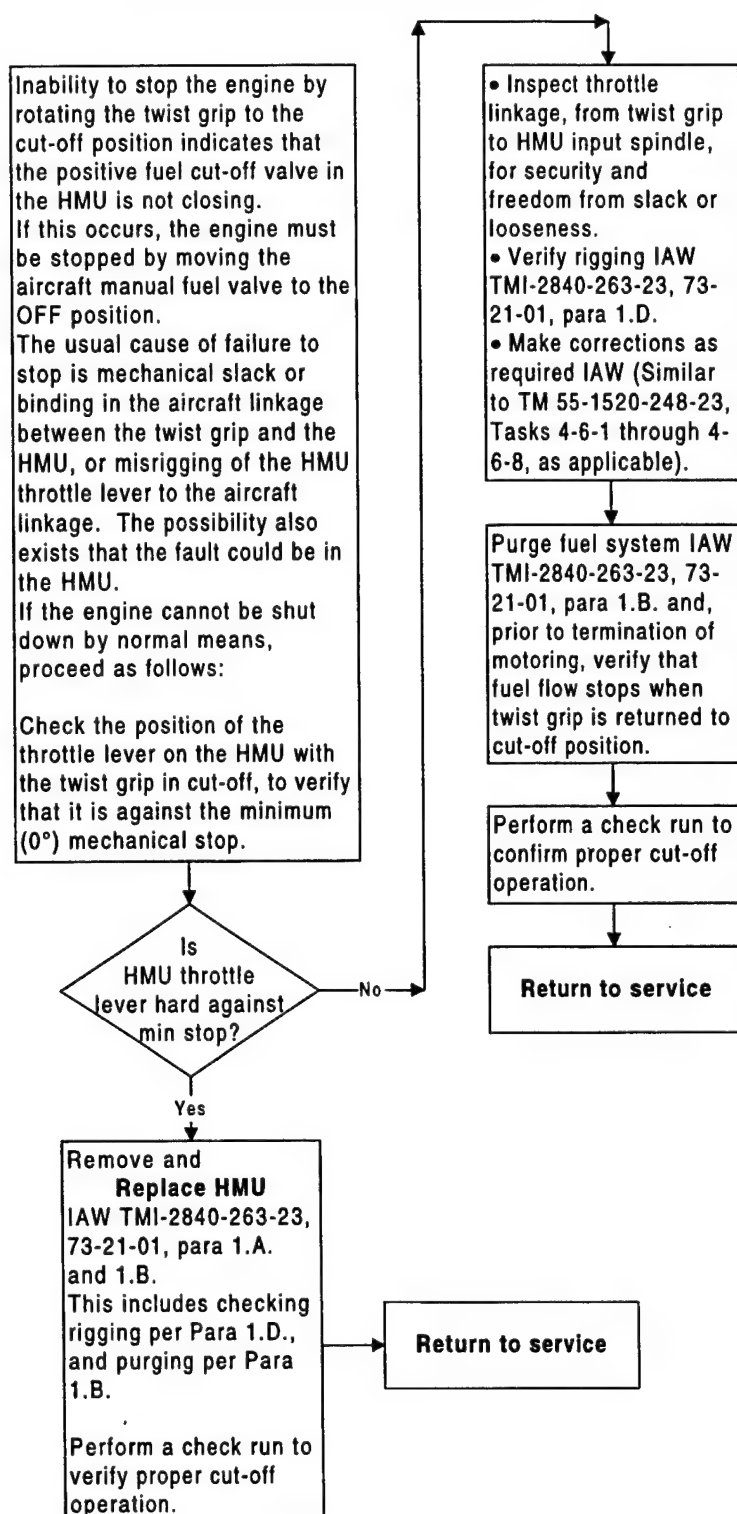




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## SD-4. Unable To Stop Engine With Twist Grip

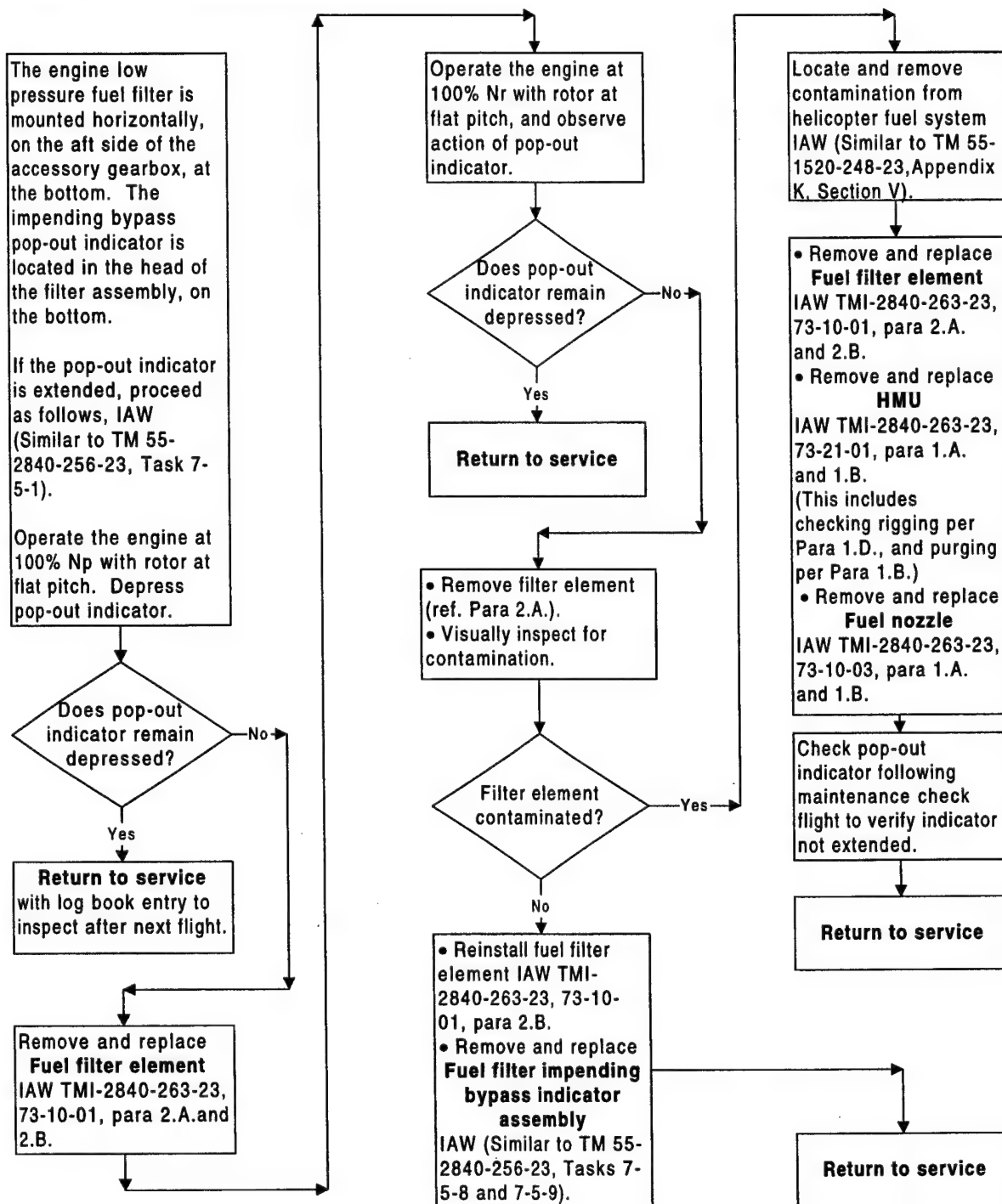
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# Off-1. Filter (Engine Fuel) Impending Bypass Indicator Extended

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## Off-2. Filter (Main Oil) Impending Bypass Indicator Extended

Page 1 of 1

The impending bypass pop-out indicator for the engine main oil filter is located in the oil filter cap, atop the accessory gearbox.

If the pop-out indicator is extended, proceed as follows, IAW TMI-2840-263-23, 72-60-00, para 1.C.

Operate engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.

Press pop-out indicator in and operate engine throughout range from ground idle to light-on-skids power.

Does pop-out indicator remain depressed?

Yes

Return to service

- Remove, inspect, service, and reinstall oil filter element, IAW TMI-2840-263-23, 72-60-00, para 1.C.
- Warm engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.
- Press pop-out indicator in.
- Operate engine throughout range from ground idle to light-on-skids power.

Does pop-out indicator remain depressed?

Yes

Return to service

Remove oil filter element (Para 1.C.) and reinspect for indications of oil contamination

Contamination noted?

No

- Remove and replace Oil filter impending bypass indicator IAW TMI-2840-263-23, 72-60-00, para 1.D.
- Reinstall oil filter element (ref. Task 6-2-13).
- Warm engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.
- Press pop-out indicator in.
- Operate engine throughout range from ground idle to light-on-skids power.

Service engine oil system IAW TMI-2840-263-23, 72-00-00, para 1.D. This includes the following:

- Drain oil tank (Similar to TM 55-1520-248-23, Task 1-4-5).
- Inspect oil tank for carbon, sludge, and deposits (Similar to TM 55-1520-248-23, Task 4-4-2).
- Remove, inspect, service, reinstall engine oil filter element (TMI-2840-263-23, 72-60-00, para 1.C.).
- Clean oil filter housing assembly (TMI-2840-263-23, 72-60-00, para 1.C.).
- Remove, inspect, service, and reinstall side and bottom chip detectors (TMI-2840-263-23, 72-60-00, para 4.B.).
- If contaminants noted in oil, remove, clean, and reinstall oil pressure reducer (TMI-2840-263-23, 72-00-00, para 8.A., Lubrication System Servicing), and flush aircraft oil lines, oil cooler, and oil cooler bypass valve.
- Remove and replace scavenge oil filter element IAW (Similar to TM 55-1520-248-23, Task 4-4-17).
- Service engine oil system IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

- Warm engine at 100% Np, with rotor at flat pitch, until oil reaches stabilized operating temperature.
- Press pop-out indicator in.
- Operate engine throughout range from ground idle to light-on-skids power.
- Verify pop-out indicator remains depressed.

Return to service

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# Off-3. Oil Tank Level Lowering With Engine Inoperative

Page 1 of 3

When the oil tank level drops with the engine inoperative, it is usually because of leakage from the tank back to the accessory gearbox through:

- A faulty internal check valve
- Oil transfer tube(s)
- Oil pump flange(s).

Also, inadequate oil scavenging during engine coastdown can result in oil retention in the accessory gearbox at shutdown, which produces a similar effect.

If lowering of the oil tank level with the engine inoperative is observed, proceed as follows to resolve the problem.

- Check oil level to confirm level in tank has lowered since engine shutdown.
- Motor engine with starter for 30 seconds and check oil level immediately after coastdown.

Is proper oil tank level restored?

Yes

Return to service

No

- Start engine and operate at ground idle until oil temperature stabilizes.
- Shut down and check oil level immediately after Ng rotation ceases.

Is proper oil tank level restored?

Yes

Return to service

No

- Remove bottom magnetic chip detector IAW TMI-2840-263-23, 72-60-00, para 4.b.
- Capture oil draining from chip detector port and measure quantity.

Is amount drained less than 900 cc?

Yes

- Reinstall bottom chip detector per Task 6-3-6.
- Service (top off) oil tank IAW (Similar to TM 55-1520-248, Task 1-4-5.1).

Return to service

No

- Disconnect engine Oil In and Oil Out lines at accessory gearbox, and plug and cap exposed lines and fittings.
- Remove oil filter element IAW TMI-2840-263-23, 72-60-00, para 1.C.
- Fill oil filter cavity with engine oil.
- Check level of oil in filter cavity after 30-60 minutes.

Has oil level in filter cavity dropped?

Yes

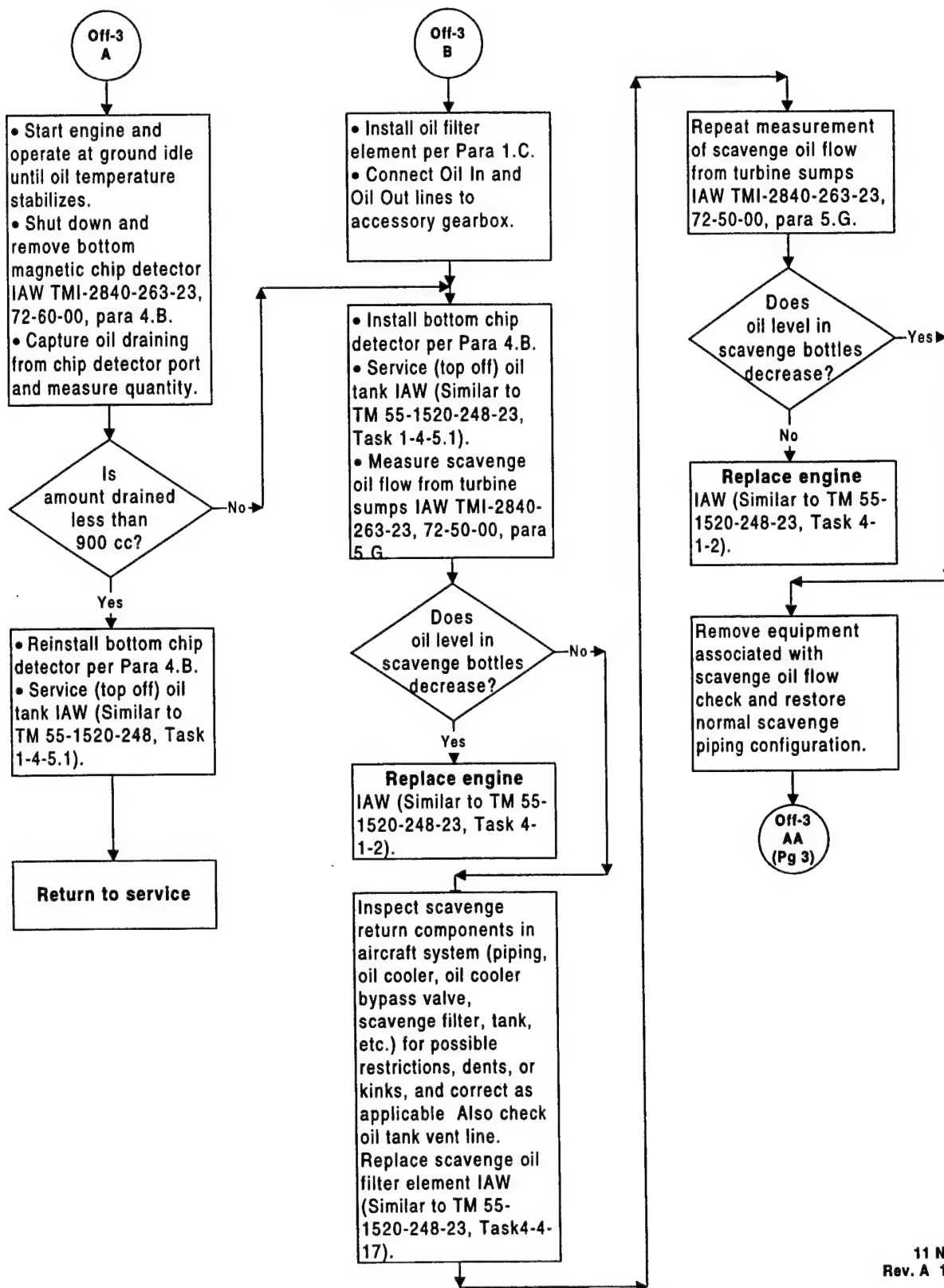
- Remove oil filter housing IAW TMI-2840-263-23, 72-60-00, para 1.d.
- Remove and replace **Oil check valve** and reinstall oil filter housing, per Para 1.D., being sure to replace O-rings on check valve and oil transfer tubes, and gasket on oil filter housing.
- Install oil filter element per Para 1.C.
- Connect Oil In and Oil Out lines to accessory gearbox.
- Install bottom chip detector per Para 4.B.
- Service (top off) oil tank IAW (Similar to TM 55-1520-248-23, Task 1-4-5.1).

Off-3  
A  
(Pg 2)

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# Off-3. Oil Tank Level Lowering With Engine Inoperative

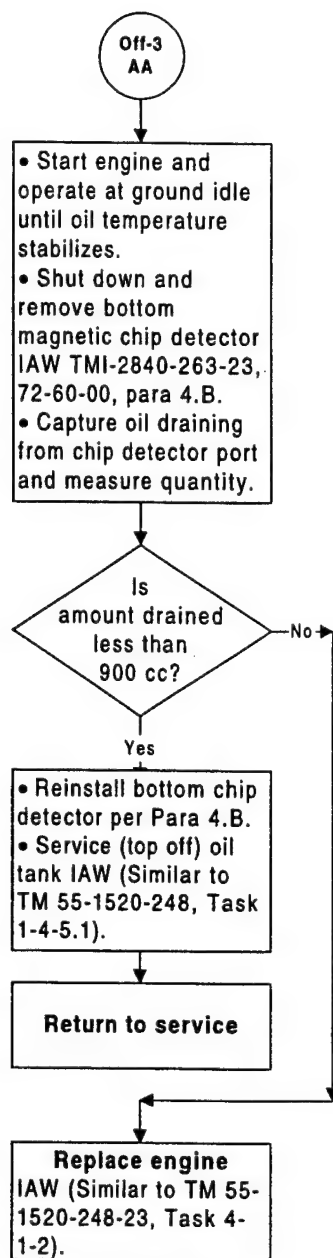
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### Off-3. Oil Tank Level Lowering With Engine Inoperative

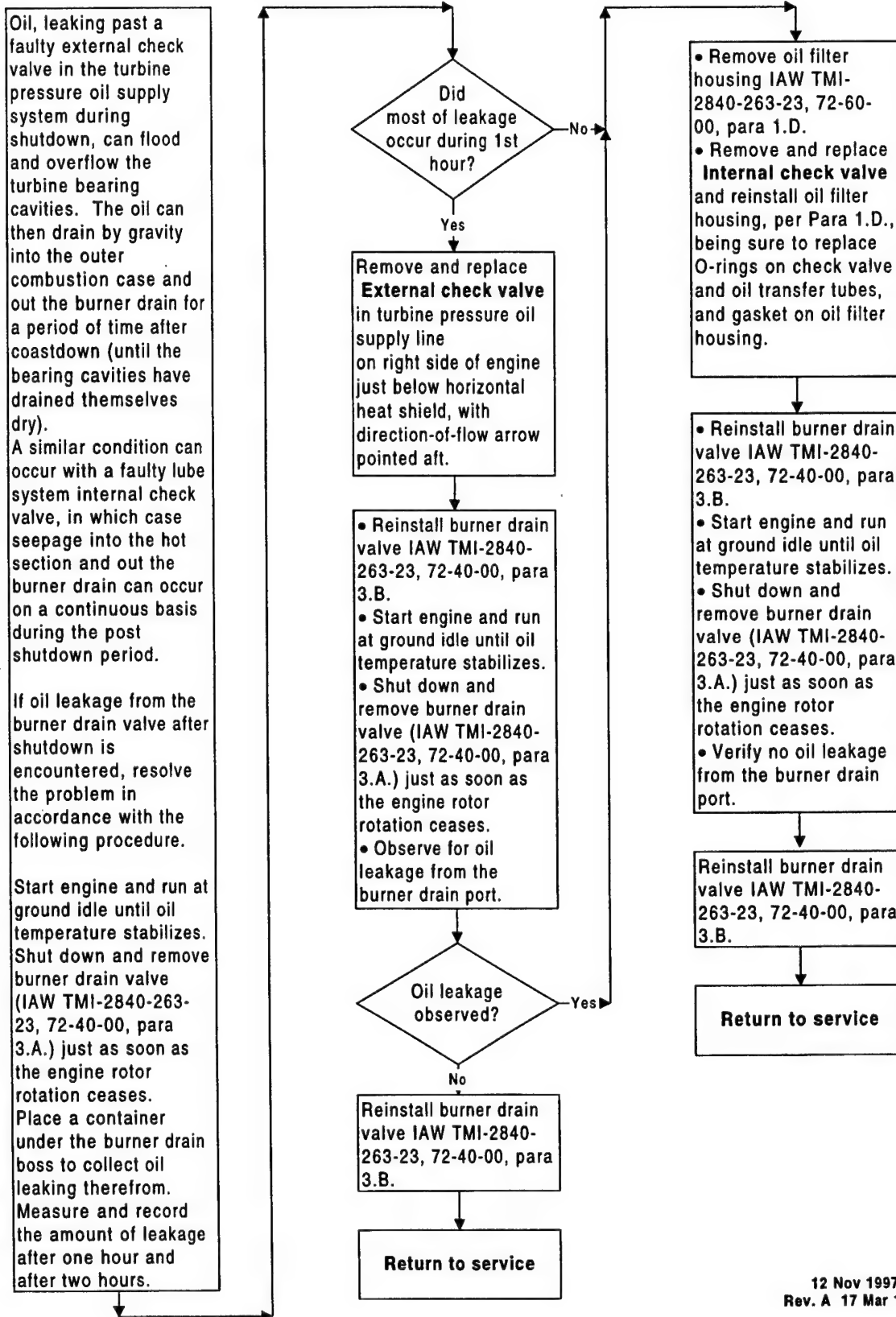
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## Off-4. Oil Runs From Burner Drain Valve After Shutdown

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# Off-5. Starter Will Not Rotate Engine Immediately After Shutdown

Page 1 of 2

Rotating and stationary members of the turbine cool at different rates following shutdown. This can result in contact or interference at close clearance locations, until temperatures stabilize or equalize. During this period of contact, the starter is sometimes unable to rotate the engine. Additional cooling time usually eliminates the contact and allows normal motoring and operation. In some cases, however, rub or mechanical binding in other components can prevent rotation by the starter and can require module changes or engine replacement to resolve.

If the starter is unable to motor engine immediately after shutdown, proceed as follows:

Allow engine to cool naturally (without motoring) to as close to ambient temperature as practicable, but certainly no hotter than MGT of 150°C (302°F), and attempt a start.

Able to start satisfactorily?

Yes

Return to service

No

- Remove engine IAW (Similar to TM 55-1520-248-23, Task 4-1-1).
- Remove Compressor module IAW TMI-2840-263-23, 72-30-00, para 1.A.
- Inspect compressor rotor for freedom of rotation, and absence of rub or mechanical damage.

Is compressor satisfactory?

Yes

No

Replace compressor module

- Remove turbine module IAW TMI-2840-263-23, 72-50-00, para 1.A.
- Check turbine gas generator rotor for freedom of rotation.
- Remove combustion module IAW TMI-2840-263-23, 72-40-00, para 1.A. and 2.A.
- Inspect turbine 1st stage nozzle shield, nozzle and wheel IAW TMI-2840-263-23, 72-50-00, para 5.C. and 5.D.

Is turbine satisfactory or repairable?

Yes

No

Replace turbine module

Reinstall first stage nozzle shield (replace existing part if condition requires)  
Ref. TMI-2840-263-23, 72-50-00, para 2.B.

Check accessory gearbox power gear train and gas generator gear train for freedom of rotation.

Is accessory gearbox satisfactory?

Yes

No

Replace accessory gearbox module IAW TMI-2840-263-23, 72-60-00, para 1.A.

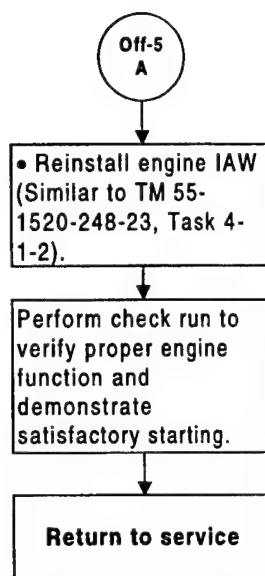
- Install compressor module IAW TMI-2840-263-23, 72-30-00, para 1.B.
- Install turbine module per 72-50-00, para 1.B.
- Reinstall combustion module per 72-40-00, para 1.B. and 2.A.

Off-5  
A  
(Pg 2)

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## Off-5. Starter Will Not Rotate Engine Immediately After Shutdown

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## **Appendix C**

### **Model 250-C30R/3 FADEC Fault Isolation and Correction Visio Charts**

57 Procedures (112 pages)

**ASSOCIATED FAULT INDICATION(S):**SmFlt, SmPhAVFlt, SmPhBVFlt,  
SmPhCVFlt, SmPhDVFlt, SmPhIFlt**DESCRIPTION:**THE ECU POWER-UP  
TEST INDICATES A  
PROBLEM WITH THE  
ECU/HMU STEPPER  
MOTOR CIRCUIT**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- ECU FAILURE
- HMU STEPPER MOTOR FAILURE
- HARNESS FAILURE

PROCEED AS  
FOLLOWS TO  
RESOLVEDEPOWER AIRCRAFT  
(SIMILAR TO TM 55-  
1520-248-23, TASK 9-3-  
11)BEFORE  
DISCONNECTING ANY  
CONNECTOR, FIRST  
CHECK FOR  
LOOSENESS AS  
POSSIBLE CAUSE OF  
FAULT.IS CONNECTOR  
TIGHT?

No

TIGHTEN THE  
CONNECTOR,  
ENSURING PROPER  
KEYING BETWEEN THE  
MATING PLUG AND  
RECEPTACLE

Yes

B  
(PG 2)

- RECONNECT 1A6P1
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PERFORM MANUAL/AUTO RESET OF FADEC
- WAIT ABOUT 10 SECONDS AND ROLL TWIST GRIP TO GND IDLE POSITION
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY

Yes

ARE  
RESISTANCE  
MEASUREMENTS  
WITHIN  
LIMITS?No  
A  
(PG 2)AT CONNECTOR 1A6P1, MEASURE  
RESISTANCE OF EACH OF 4  
STEPPER MOTOR WINDINGS  
THROUGH THE HARNESS.

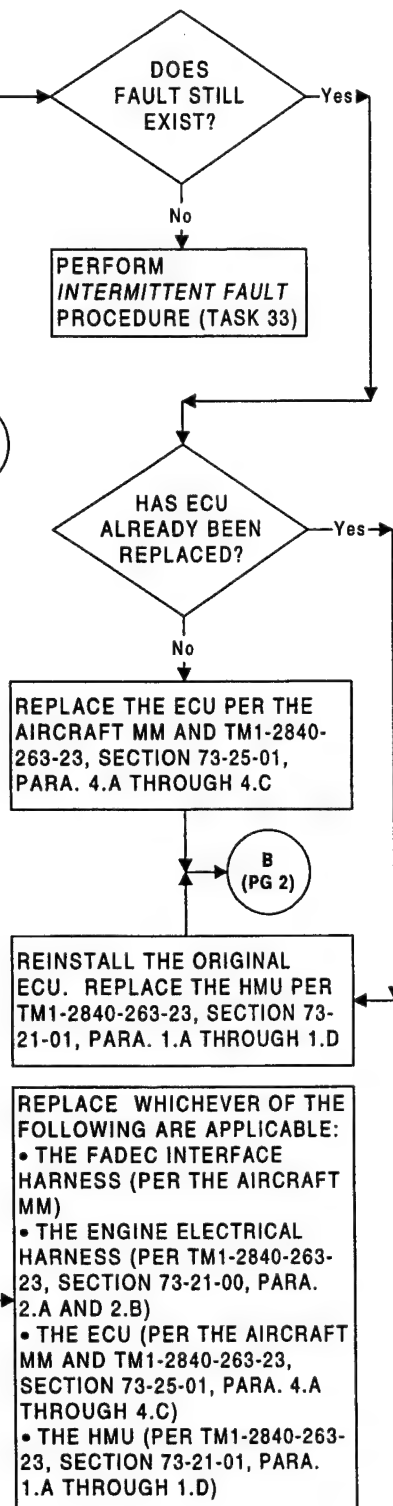
SOCKETS	LIMITS (Ω)	NOM (Ω)
1 & 5	20-40	30
2 & 5	20-40	30
3 & 5	20-40	30
4 & 5	20-40	30

SOCKET-TO-GROUND: &gt;1 MEGOHM

AFTER  
DISCONNECTING ANY  
CONNECTOR,  
IMMEDIATELY  
EXAMINE PINS AND  
SOCKETSARE PINS OR  
SOCKETS BENT,  
RECESSED OR  
MISSING?

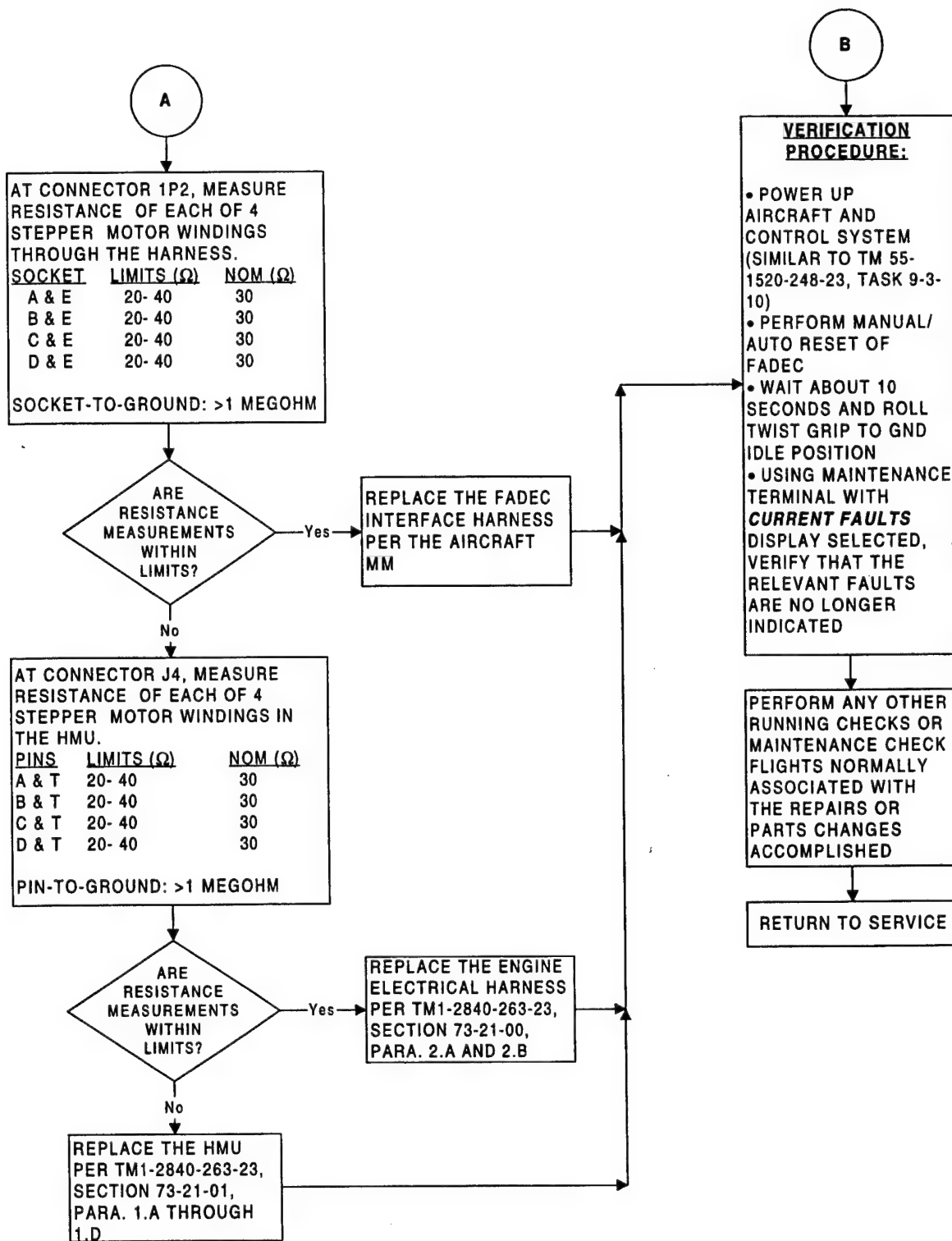
Yes

No

REPLACE THE ECU PER THE  
AIRCRAFT MM AND TM1-2840-  
263-23, SECTION 73-25-01,  
PARA. 4.A THROUGH 4.CREINSTALL THE ORIGINAL  
ECU. REPLACE THE HMU PER  
TM1-2840-263-23, SECTION 73-  
21-01, PARA. 1.A THROUGH 1.DREPLACE WHICHEVER OF THE  
FOLLOWING ARE APPLICABLE:  
• THE FADEC INTERFACE  
HARNESS (PER THE AIRCRAFT  
MM)  
• THE ENGINE ELECTRICAL  
HARNESS (PER TM1-2840-263-  
23, SECTION 73-21-00, PARA.  
2.A AND 2.B)  
• THE ECU (PER THE AIRCRAFT  
MM AND TM1-2840-263-23,  
SECTION 73-25-01, PARA. 4.A  
THROUGH 4.C)  
• THE HMU (PER TM1-2840-263-  
23, SECTION 73-21-01, PARA.  
1.A THROUGH 1.D)

21 AUG 1998

# 1. STEPPER MOTOR CIRCUIT FAULT



21 AUG 1998

## 2. HOT START ABORT SOLENOID CIRCUIT FAULT

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
StSFIt, StSIFIt

### DESCRIPTION:

THE ECU INDICATES A PROBLEM WITH THE ECU/HMU HOT START ABORT SOLENOID CIRCUIT

### POSSIBLE CAUSES:

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU HSA SOLENOID FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

Yes

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

HAS HMU ALREADY BEEN REPLACED?

No

Yes

DOES FAULT STILL EXIST?

No

Yes

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

No

A (PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

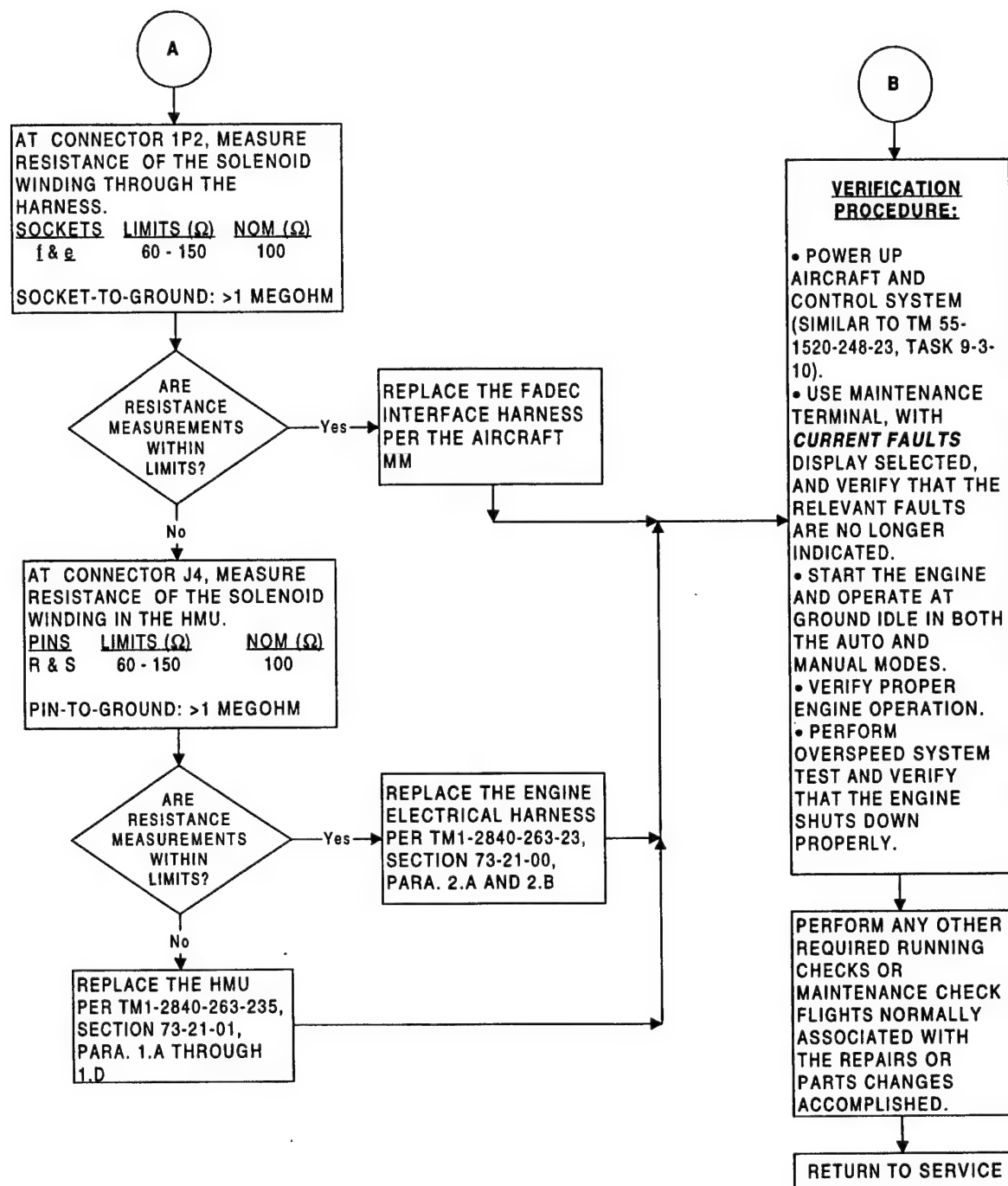
SOCKETS	LIMITS (Ω)	NOM (Ω)
11 & 10	60 - 150	100

SOCKET-TO-GROUND: >1 MEGOHM

• RECONNECT 1A6P1  
• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)  
• CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)  
• USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY

B (PG 2)

21 AUG 1998



21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**  
AMIFit, AMSolFit

## DESCRIPTION:

THE ECU INDICATES A PROBLEM WITH THE ECU/HMU AUTO/MANUAL CHANGEOVER SOLENOID CIRCUIT

## POSSIBLE CAUSES:

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU AUTO/MANUAL CHANGEOVER SOLENOID FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B  
(PG 2)

- RECONNECT 1A6P1
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY WHILE SELECTING MANUAL MODE THEN AUTO MODE TWO TIMES

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

A  
(PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.  
**SOCKETS    LIMITS (Ω)    NOM (Ω)**  
6 & 7       9-19       13  
SOCKET-TO-GROUND: >1 MEGOHM

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

DOES FAULT STILL EXIST?

Yes

No

PERFORM  
INTERMITTENT FAULT  
PROCEDURE (TASK 33)

HAS ECU  
ALREADY BEEN  
REPLACED?

Yes

No

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

B  
(PG 2)

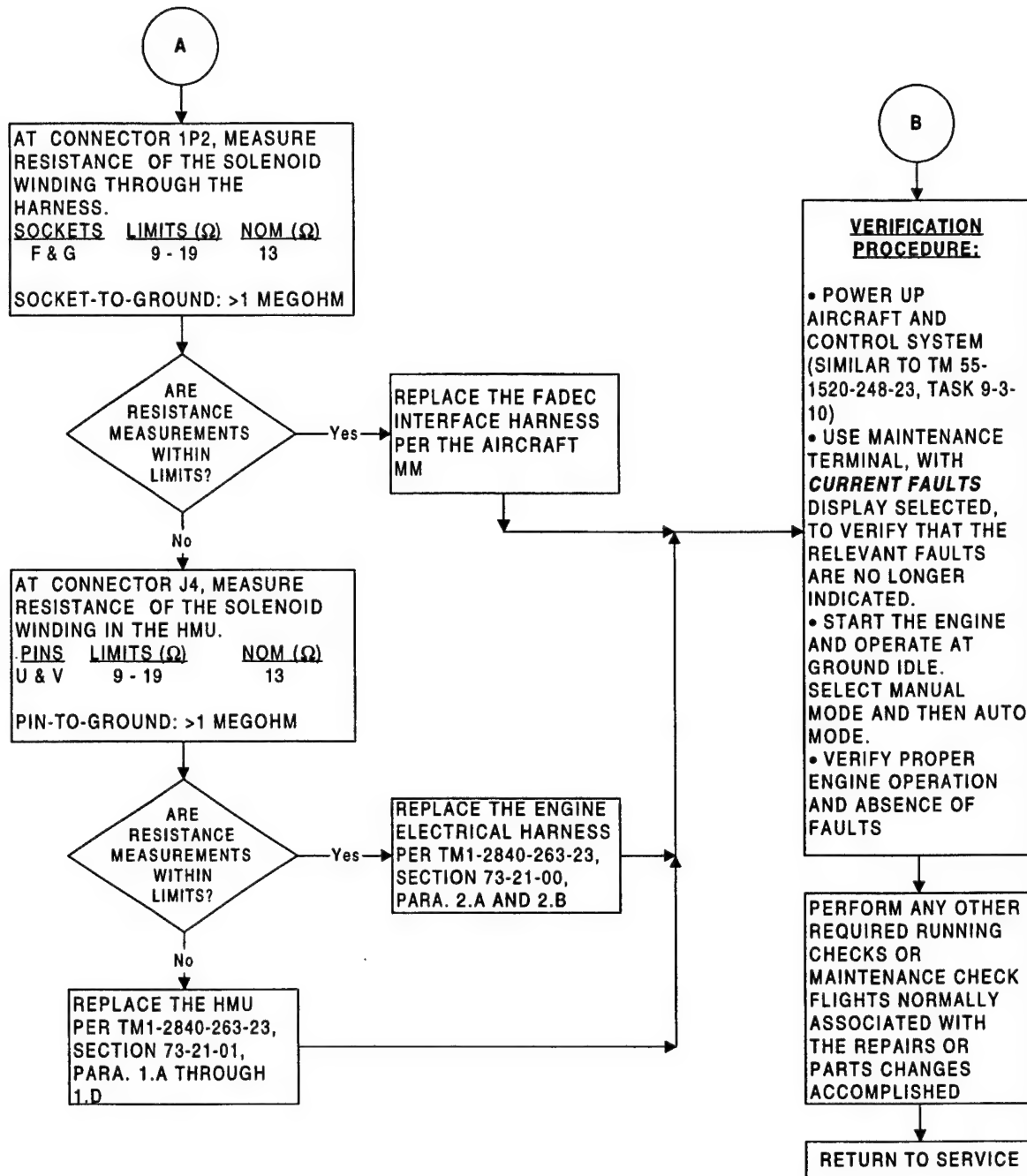
REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

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#### 4. OVERSPEED SYSTEM POWER-UP SELF TEST FAULT

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##### **ASSOCIATED FAULT INDICATION(S):**

OSI12Fit, OSTst1Fit, OSTst2Fit, OSTst3Fit,  
OSTst4Fit, OSTst5Fit, OSTst6Fit, OSTst7Fit,

##### **DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/HMU OVERSPEED SHUT-OFF SOLENOID CIRCUIT DURING POWER-UP

##### **POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU OVERSPEED SHUT-OFF SOLENOID FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B  
(PG 2)

- RECONNECT 1A6P1
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

A  
(PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
35 & 45	21 - 45	30
46 & 34	21 - 45	30

SOCKET-TO-GROUND: >1 MEGOHM

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

DOES FAULT STILL EXIST?

PERFORM  
INTERMITTENT FAULT  
PROCEDURE (TASK 33)

HAS ECU ALREADY BEEN REPLACED?

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

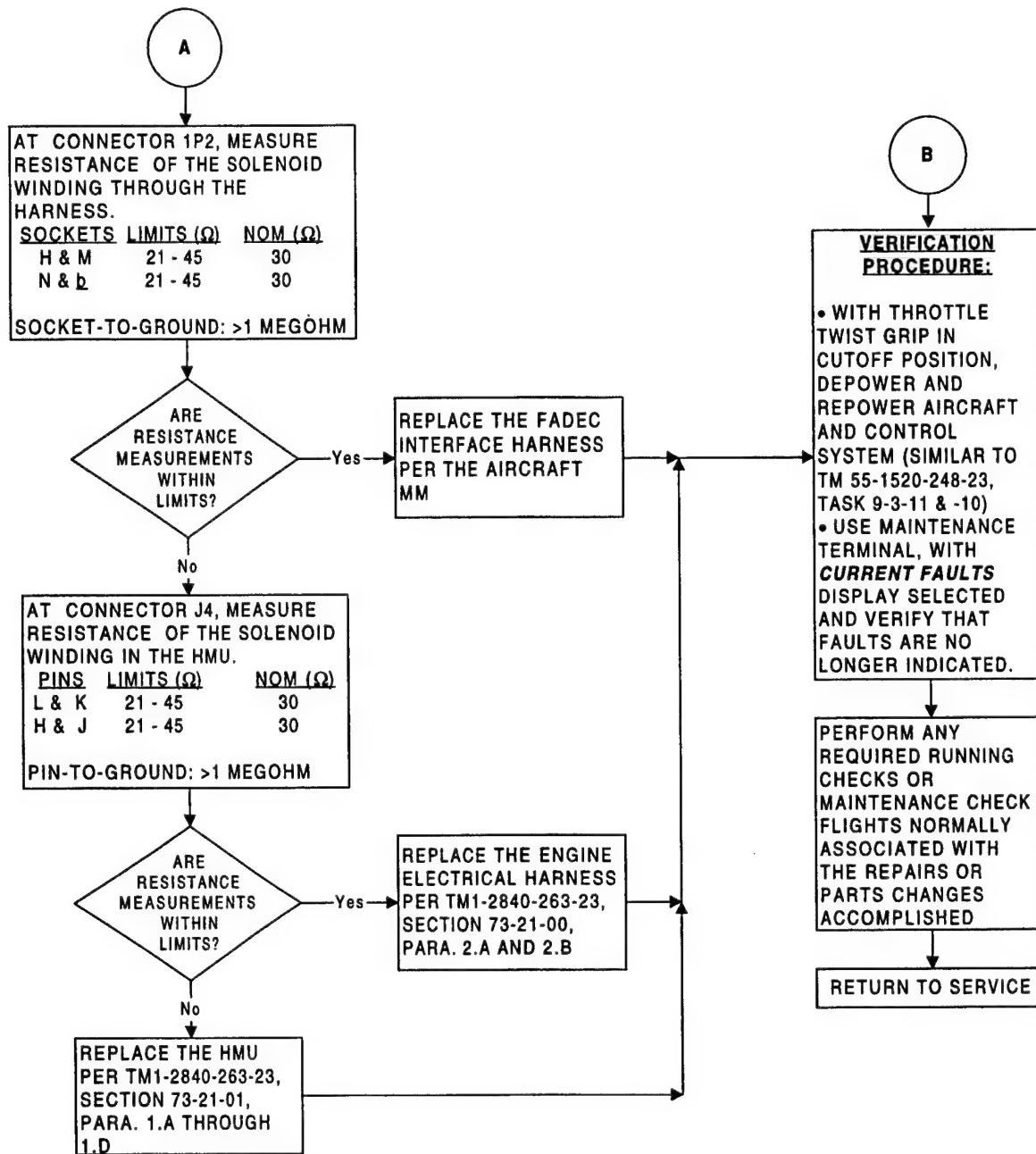
B  
(PG 2)

REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

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**ASSOCIATED FAULT INDICATION(S):**

WfmvFlt, WfmvRgFlt, WfmvRtFlt

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/HMU METERING VALVE POSITION POTENTIOMETER CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU METERING VALVE POSITION POTENTIOMETER FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**

DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B  
(PG 2)

RECONNECT 1A6P1. POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (**FADEC** CIRCUIT BREAKER 1CB15)

Yes

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

A  
(PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS	LIMITS ( $\Omega$ )	NOM ( $\Omega$ )
54 & 55	4250-5750	5000
53 & 55	1000-1500	1200
53 & 54	3500-5250	4300

SOCKET-TO-GROUND: >1 MEGOHM

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

DOES FAULT STILL EXIST?

Yes

No

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

HAS ECU ALREADY BEEN REPLACED?

Yes

No

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

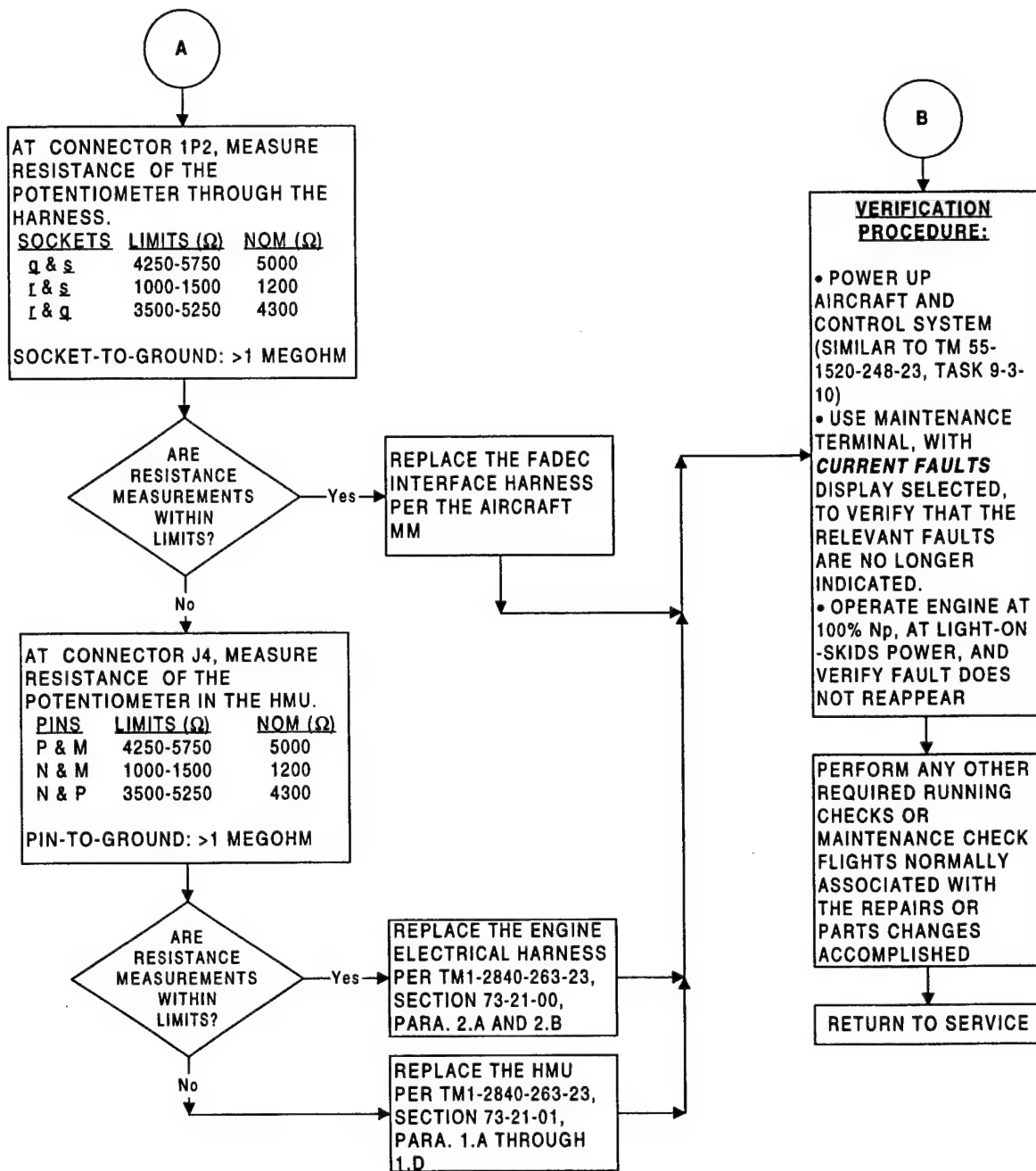
B  
(PG 2)

REINSTALL THE ORIGINAL ECU. REPLACE THE HMU PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

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## 6. POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT

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### ASSOCIATED FAULT INDICATION(S):

PLA12Fit, PLA1Fit, PLA1RgFit, PLA2Fit, PLA2RgFit,  
PLADFit, PLAHdFit, PLARiFit, PLARiRgFit

### DESCRIPTION:

THE ECU INDICATES A  
PROBLEM WITH THE ECU/  
HMU PLA POSITION  
POTENTIOMETER CIRCUIT

### POSSIBLE CAUSES:

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU PLA STOPS POSITIONED INCORRECTLY
- HMU PLA POSITION POTENTIOMETER FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO  
RESOLVE:

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- SET PLA TO GROUND IDLE POSITION (35°)

**BEFORE**  
DISCONNECTING ANY  
CONNECTOR, FIRST  
CHECK FOR  
LOOSENESS AS  
POSSIBLE CAUSE OF  
FAULT.

IS CONNECTOR  
TIGHT?

No

TIGHTEN THE  
CONNECTOR,  
ENSURING PROPER  
KEYING BETWEEN THE  
MATING PLUG AND  
RECEPTACLE

Yes

**AFTER**  
DISCONNECTING ANY  
CONNECTOR,  
IMMEDIATELY  
EXAMINE PINS AND  
SOCKETS

ARE PINS OR  
SOCKETS BENT,  
RECESSED OR  
MISSING?

Yes

No

REPLACE WHICHEVER OF THE  
FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

SET PLA TO CUTOFF  
POSITION (0°)

Yes

ARE  
RESISTANCE  
MEASUREMENTS  
WITHIN  
LIMITS?

No

AT CONNECTOR 1A6P1, MEASURE  
RESISTANCE OF THE  
POTENTIOMETER THROUGH THE  
HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
57 & 58	4250-5750	5000
56 & 58	2700-4300	3400
56 & 57	1300-2500	1800

SOCKETS	LIMITS (Ω)
51 & 52	SOCKETS 57 & 58 ± 15
50 & 52	SOCKETS 56 & 58 ± 15
50 & 51	SOCKETS 56 & 57 ± 15

SOCKET-TO-GROUND: >1 MEGOHM

AT THE SAME CONNECTOR  
(1A6P1), MEASURE RESISTANCE  
OF THE POTENTIOMETER  
THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
57 & 58	4250-5750	5000
56 & 58	4000-5700	4800
56 & 57	300-600	450

SOCKETS	LIMITS (Ω)
51 & 52	SOCKETS 57 & 58 ± 15
50 & 52	SOCKETS 56 & 58 ± 15
50 & 51	SOCKETS 56 & 57 ± 15

SOCKET-TO-GROUND: >1 MEGOHM

ARE  
RESISTANCE  
MEASUREMENTS  
WITHIN  
LIMITS?

Yes

No

REPLACE THE HMU  
PER TM1-2840-263-23,  
SECTION 73-21-01,  
PARA. 1.A THROUGH  
1.D

C

(PG 3)

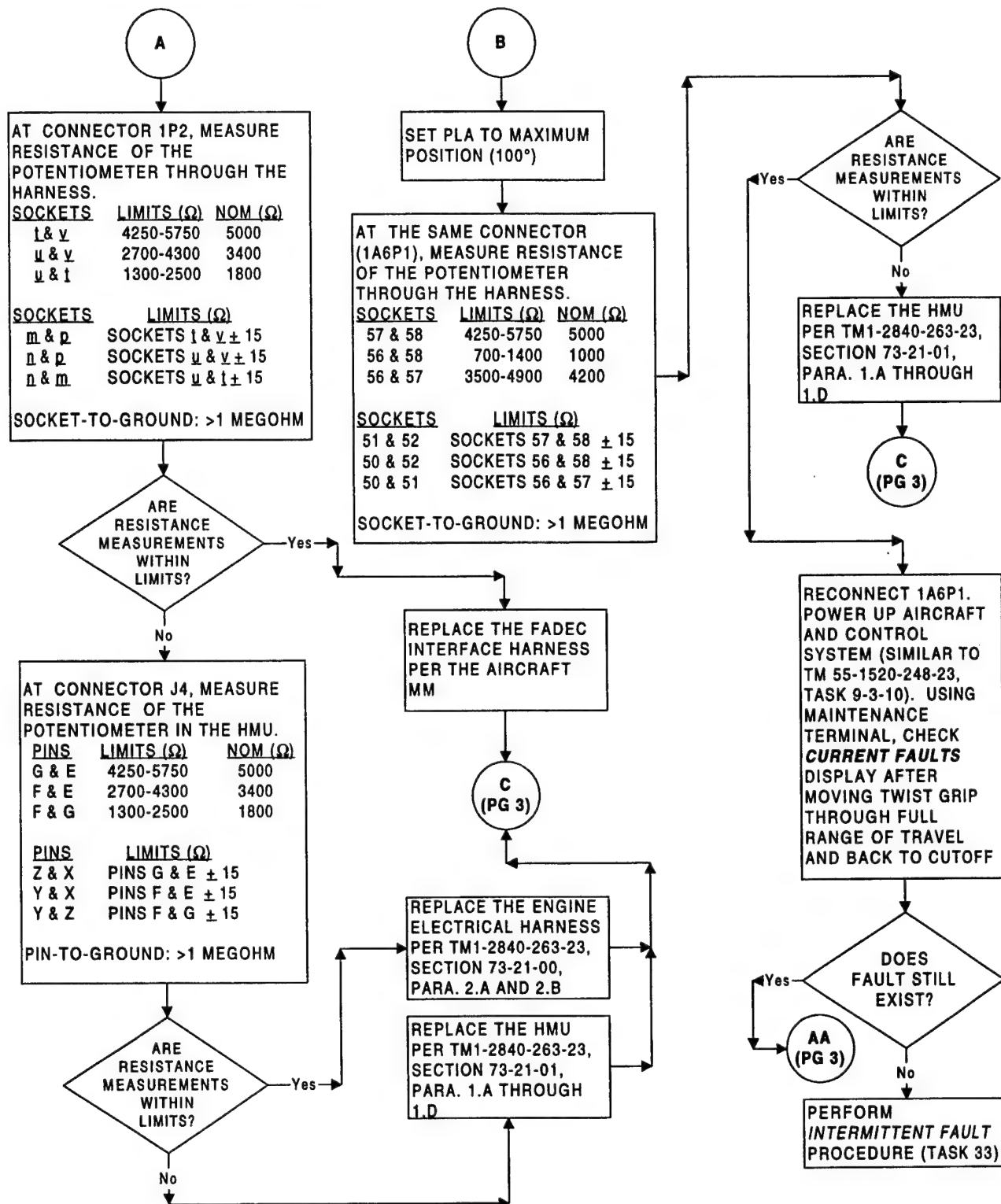
C

(PG 3)

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## 6. POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT

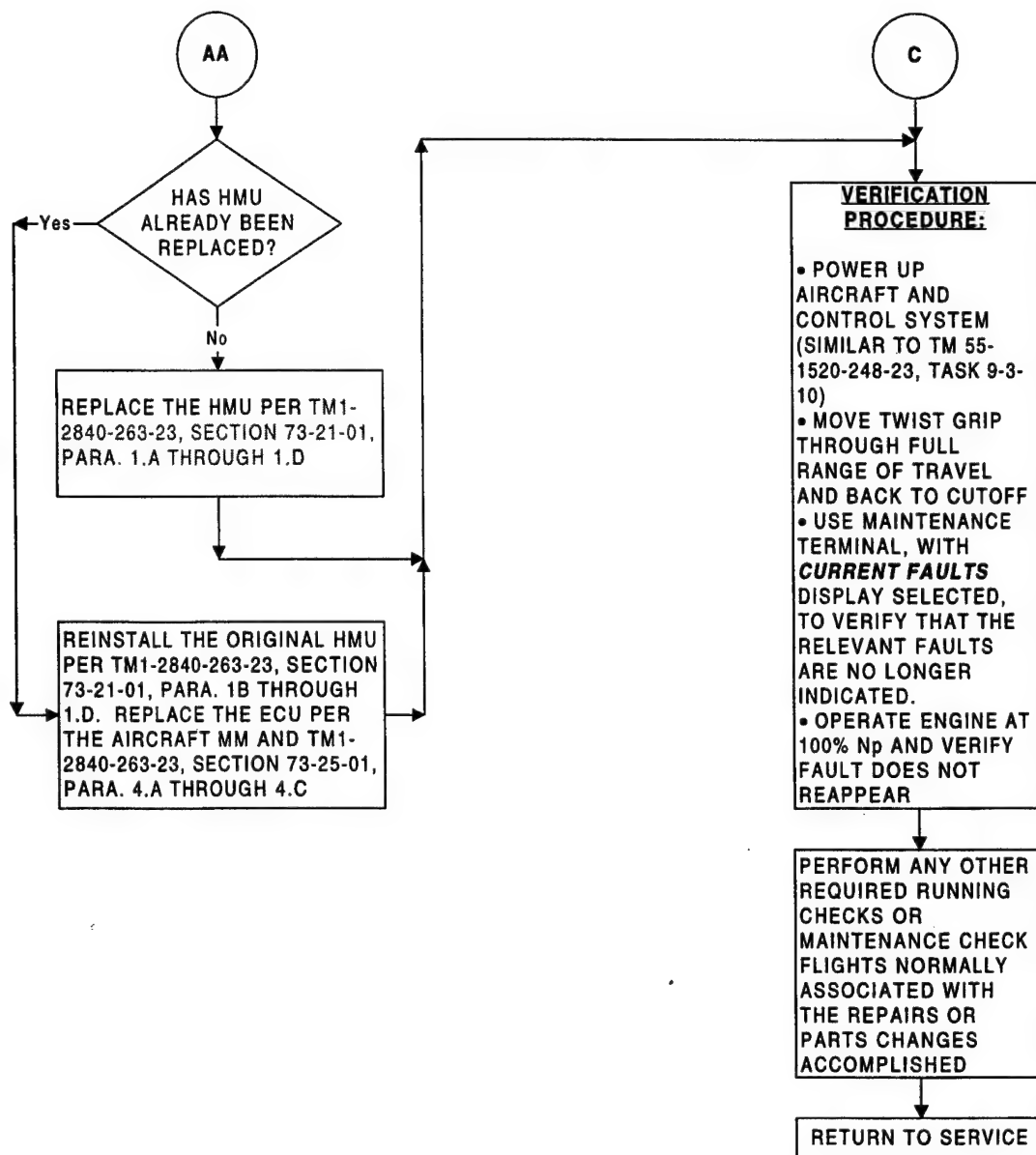
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## 6. POWER LEVER ANGLE (THROTTLE POSITION) POTENTIOMETER CIRCUIT FAULT

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**ASSOCIATED FAULT INDICATION(S):**  
T1ABFit, T1AFit, T1ARgFit, T1ARtFit,  
T1BFit, T1BRgFit, T1BRtFit, T1DFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/ T1 SENSOR CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES, OR T1 SENSOR LOOSE OR DAMAGED
- HARNESS FAILURE
- ECU FAILURE
- T1 SENSOR FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

Yes

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

**B**  
(PG 2)

RECONNECT 1A6P1. POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

Yes

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

**A**  
(PG 2)

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF EACH OF THE T1 SENSOR ELEMENTS THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
68 & 69	85-140	100
70 & 69	0-5	0
71 & 72	85-140	100
73 & 72	0-5	0

SOCKET-TO-GROUND: >1 MEGOHM

DOES FAULT STILL EXIST?

Yes

No

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

HAS T1 SENSOR ALREADY BEEN REPLACED?

Yes

No

REPLACE THE T1 SENSOR PER THE AIRCRAFT MM

**B**

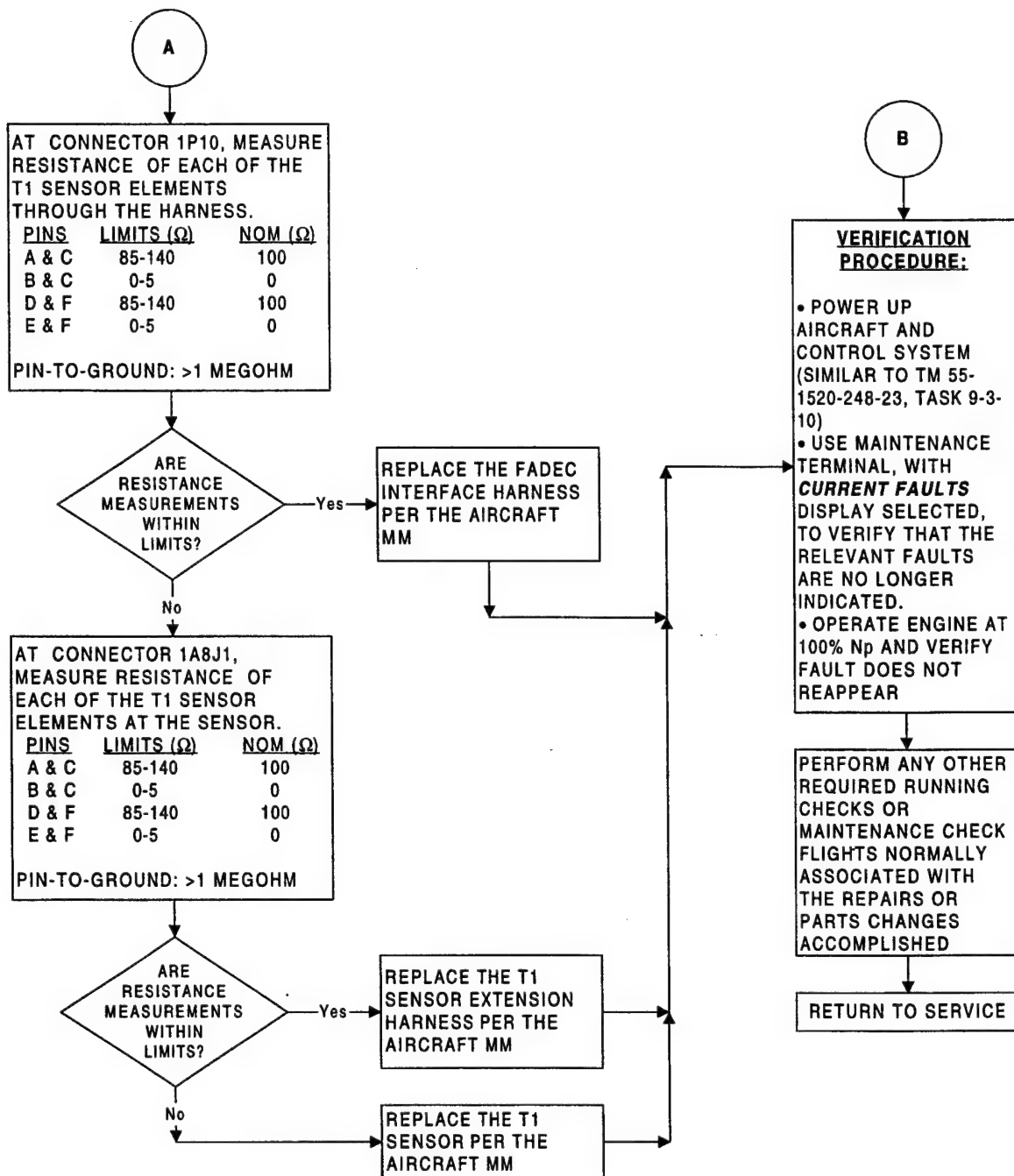
(PG 2)

REINSTALL THE ORIGINAL T1 SENSOR PER THE AIRCRAFT MM. REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

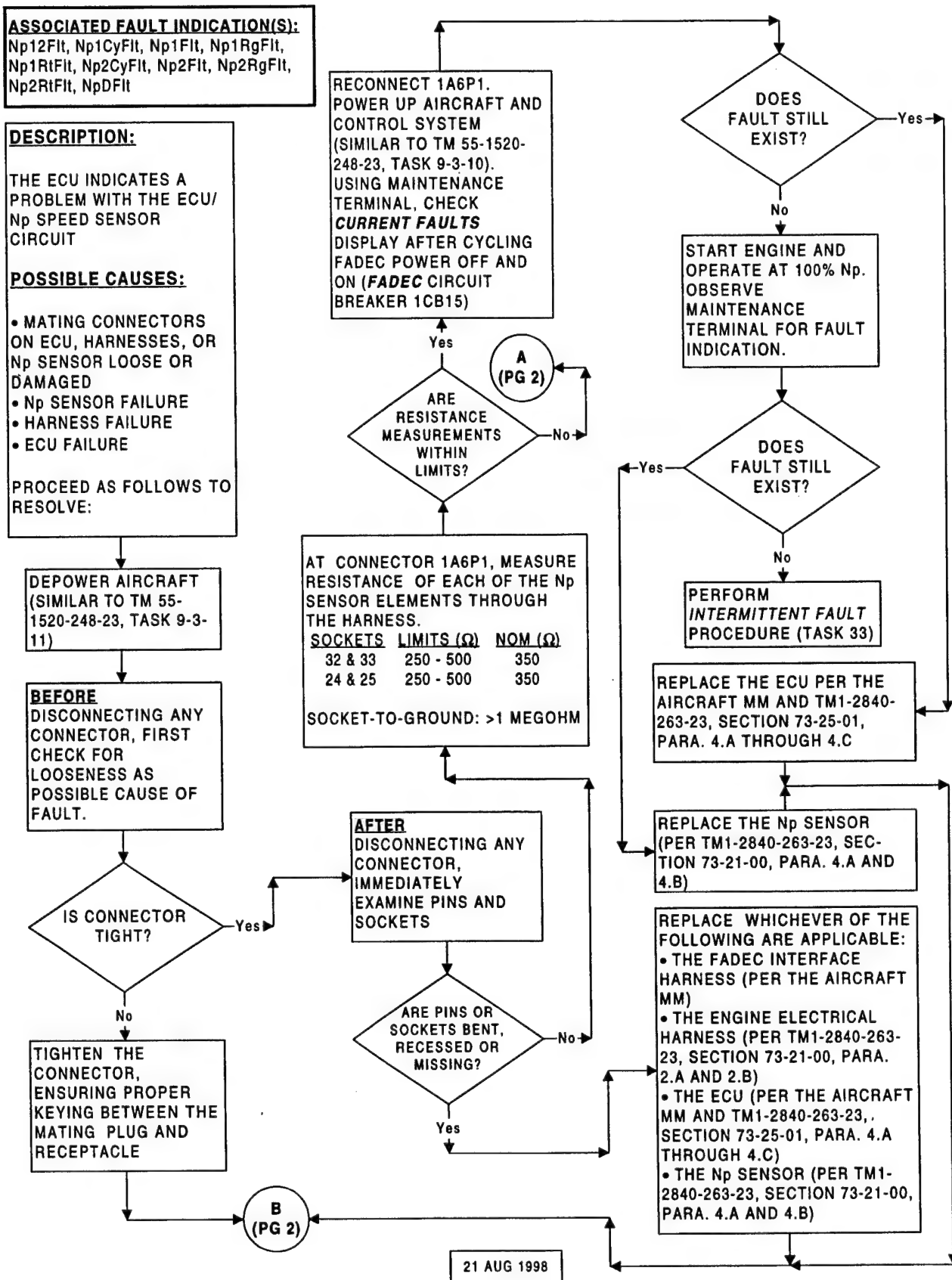
REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE T1 SENSOR EXTENSION HARNESS (PER THE AIRCRAFT MM)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE T1 SENSOR (PER THE AIRCRAFT MM)

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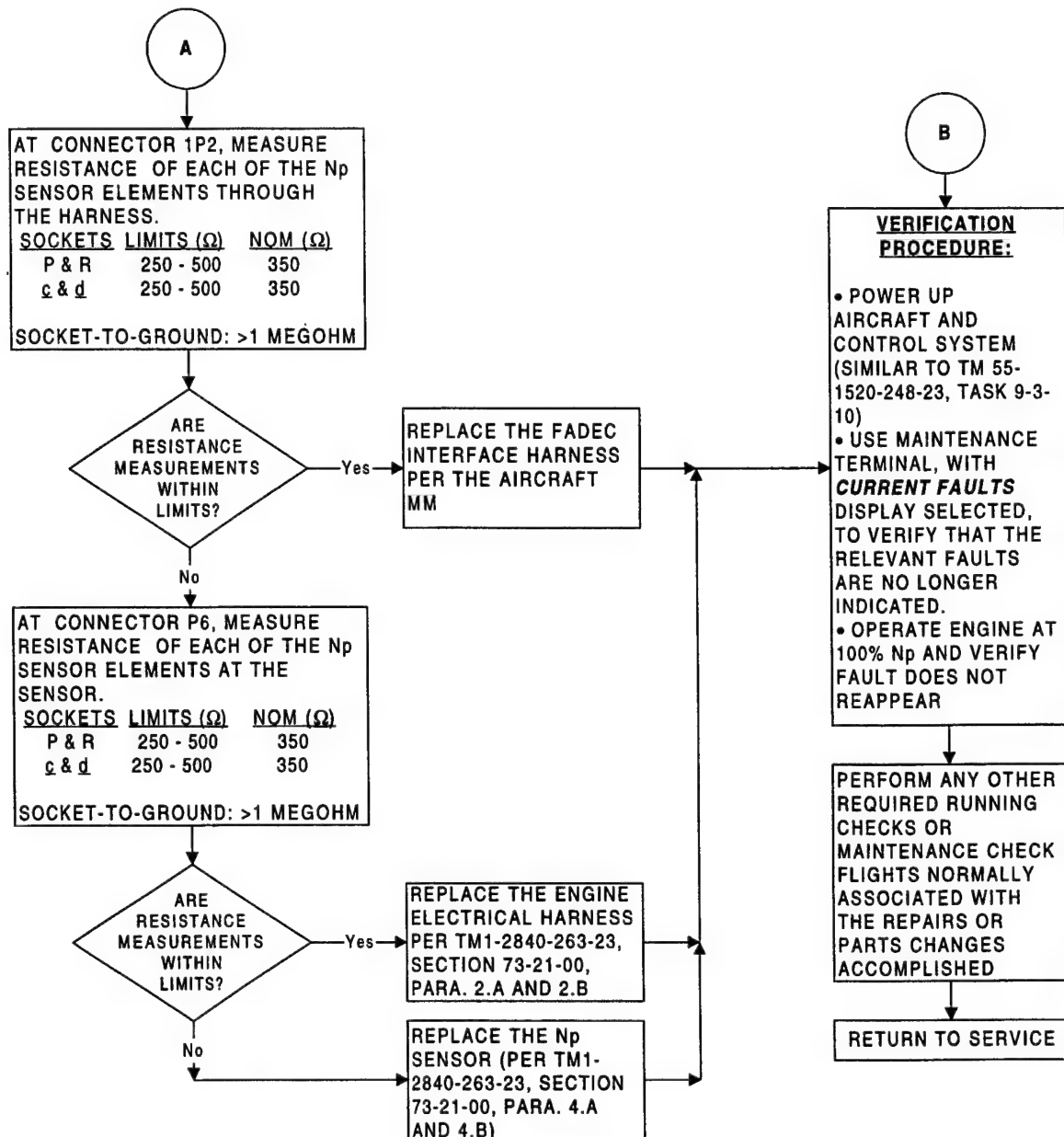


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## 8. $N_p$ ( $N_2$ ) SPEED SENSOR CIRCUIT FAULT

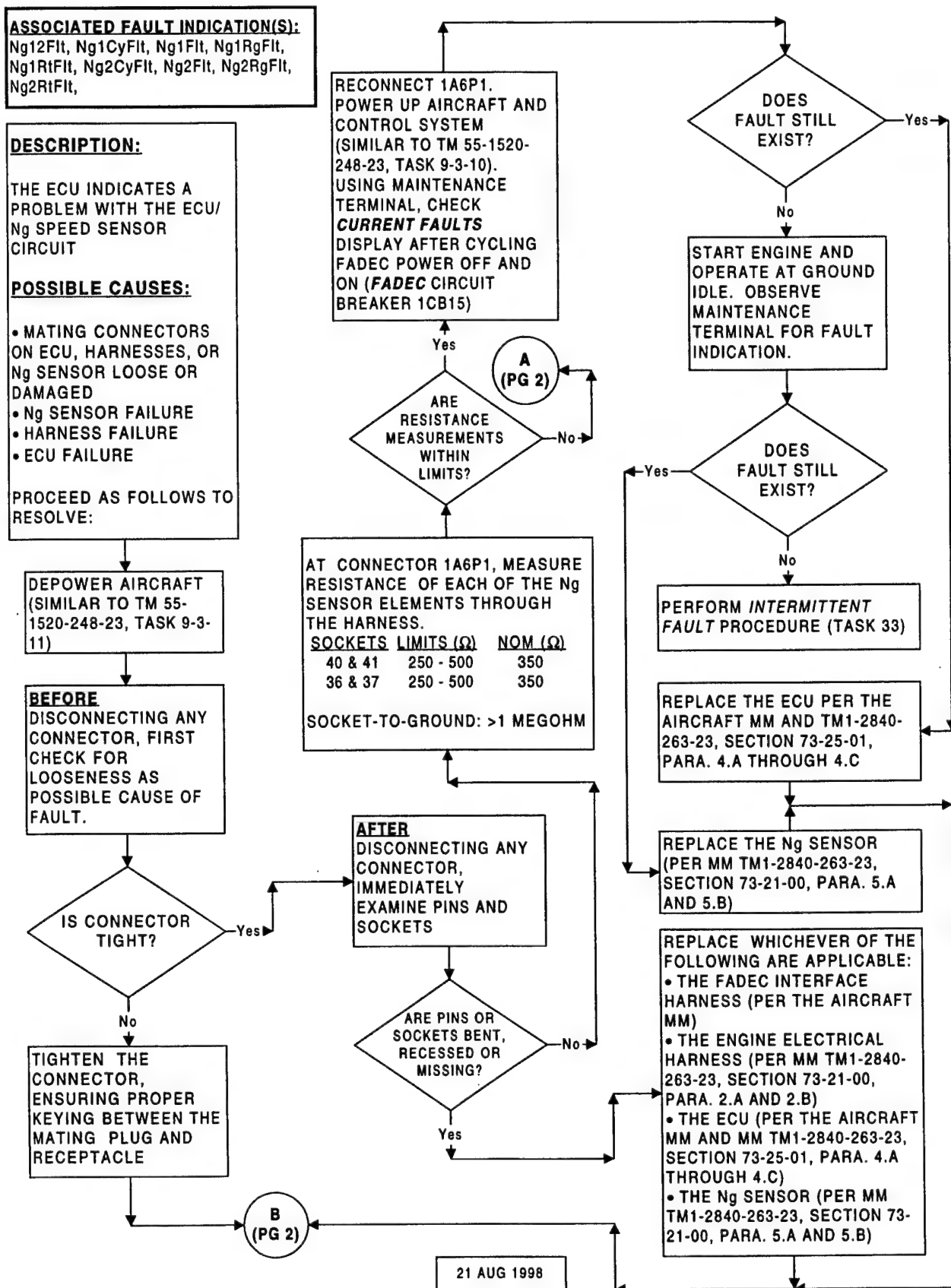
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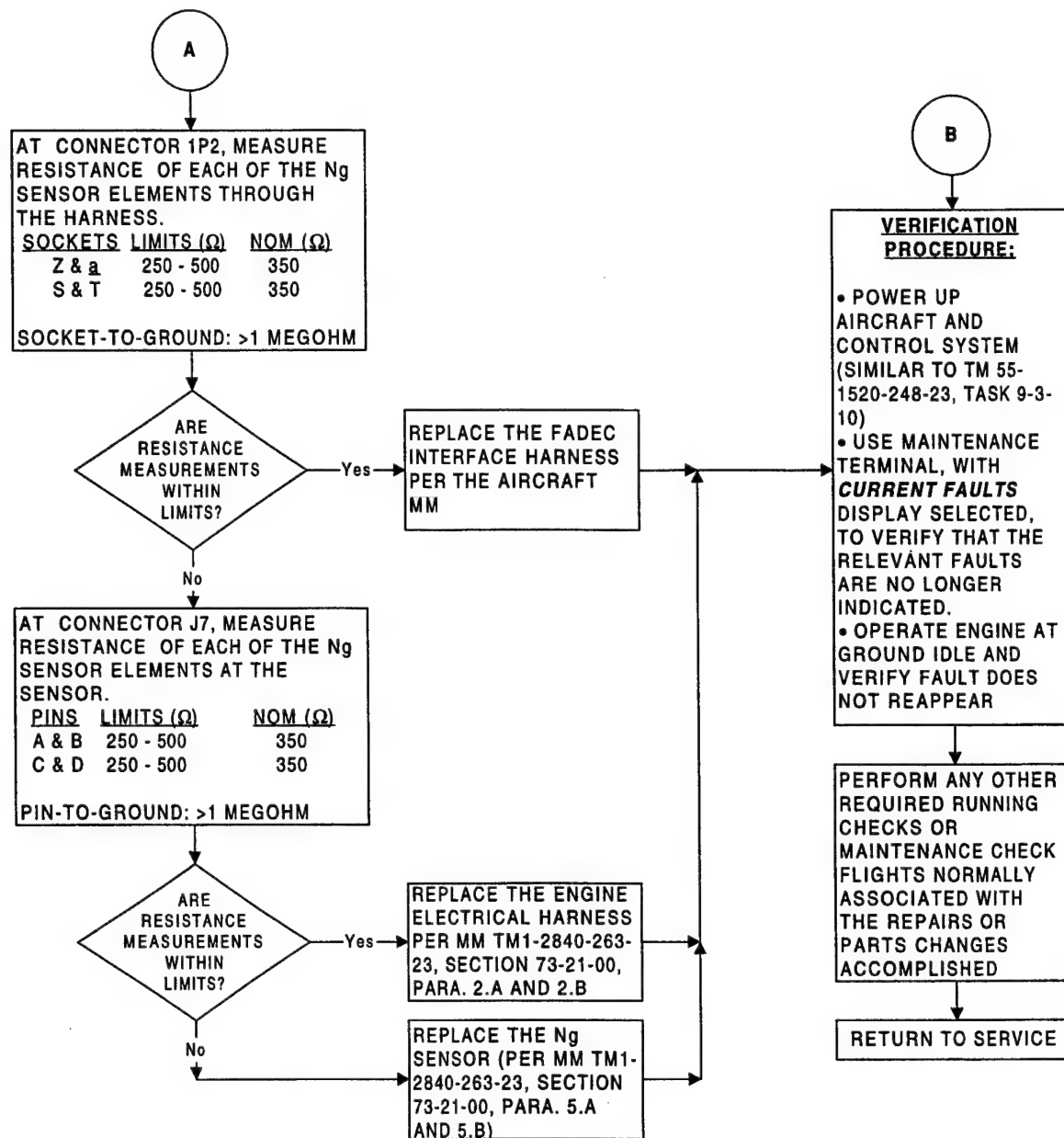
# 9. $N_g$ ( $N_1$ ) SPEED SENSOR CIRCUIT FAULT

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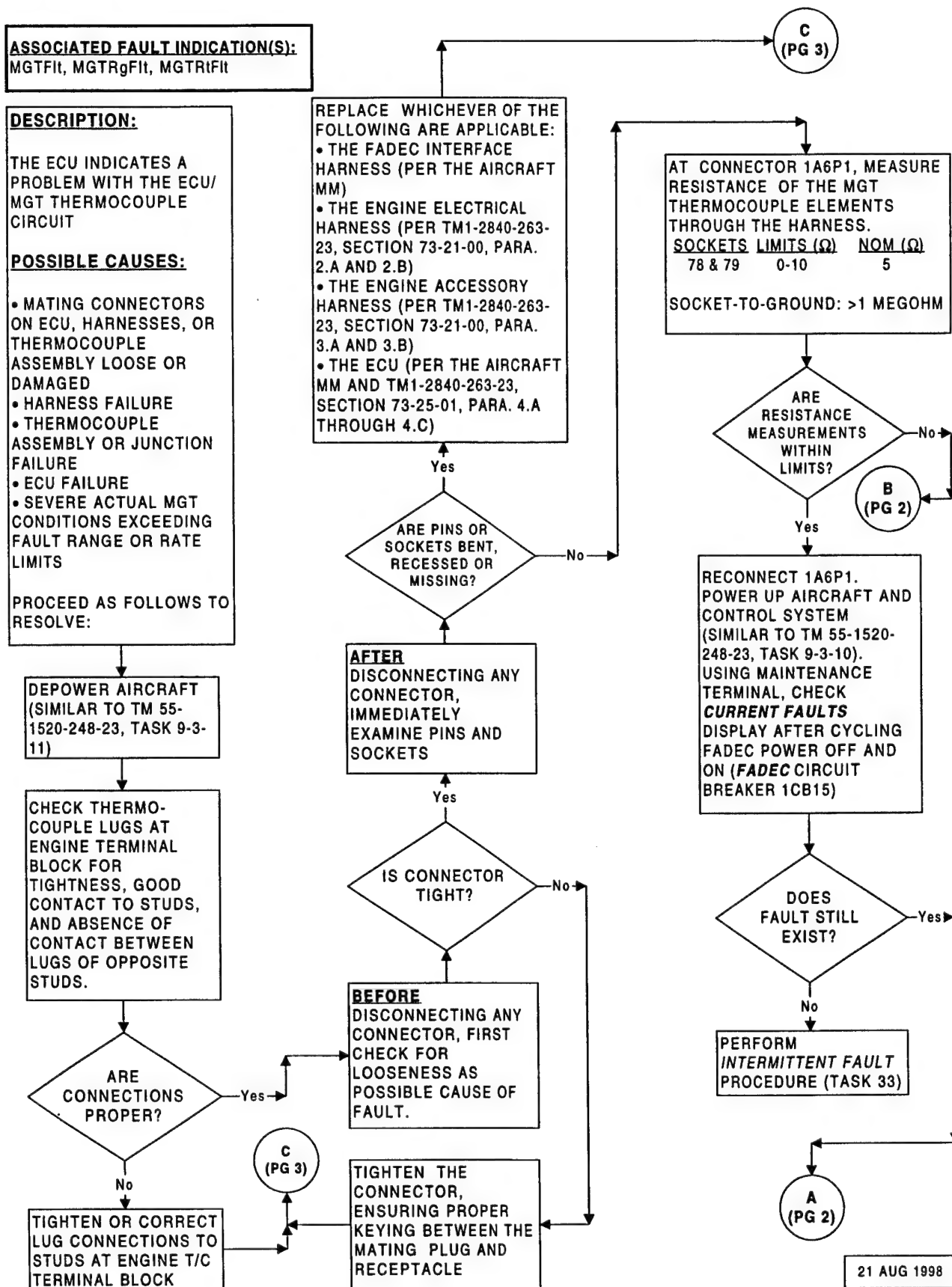


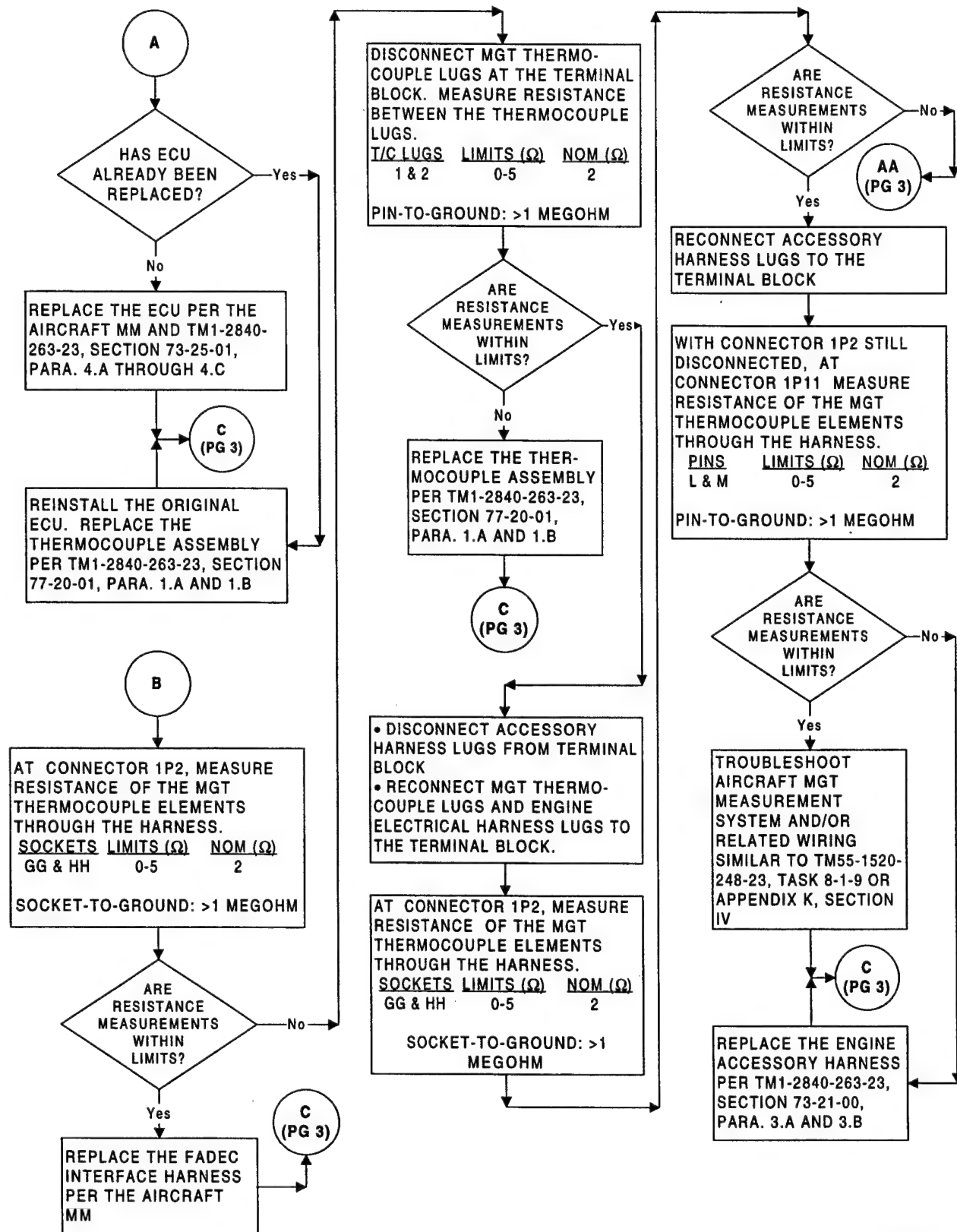
# 9. $N_g$ ( $N_1$ ) SPEED SENSOR CIRCUIT FAULT

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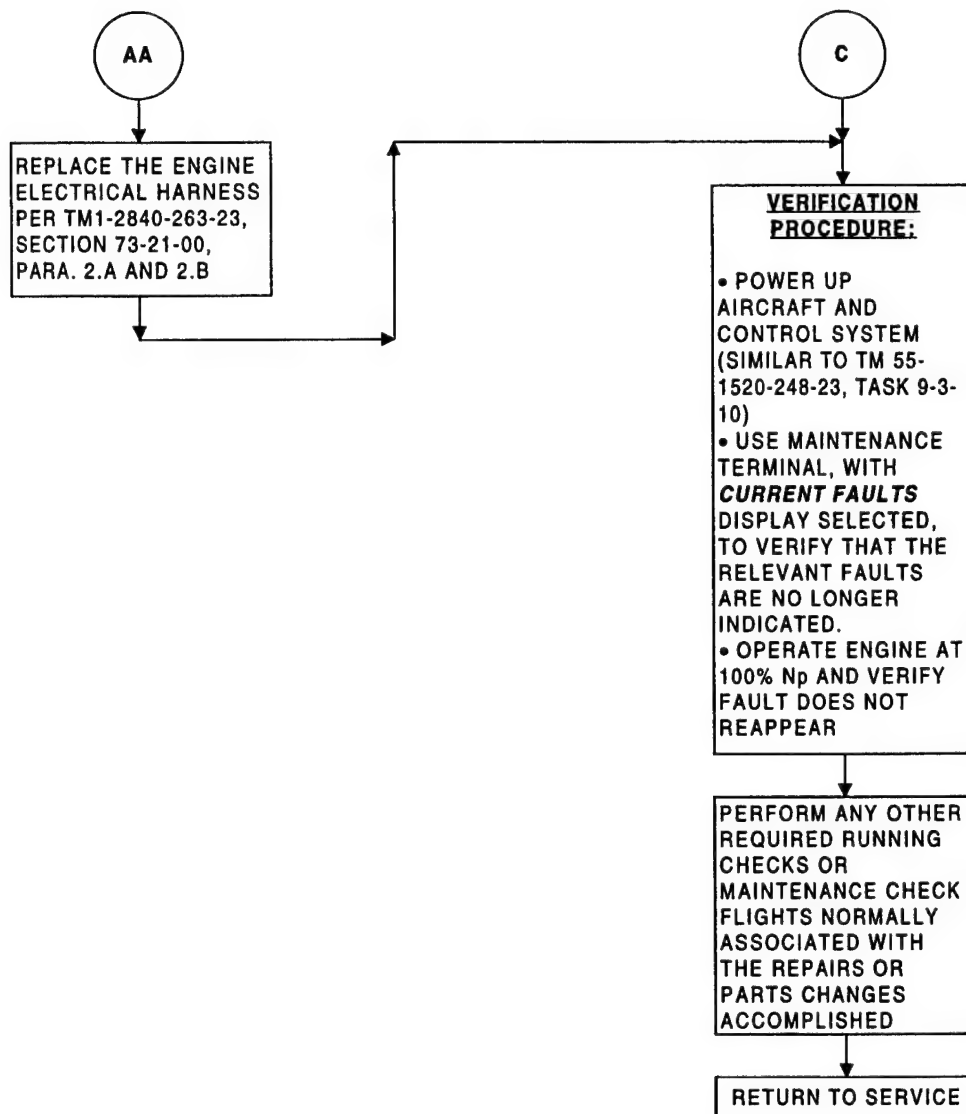
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**ASSOCIATED FAULT INDICATION(S):**  
AI28FIt

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/PERMANENT MAGNET ALTERNATOR CIRCUIT

**POSSIBLE CAUSES:**

- PMA FAILURE
- MATING CONNECTORS ON ECU, HARNESSES OR PMA LOOSE OR DAMAGED
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

Yes

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE PMA THROUGH THE HARNESS.  
**SOCKETS LIMITS (Ω) NOM (Ω)**  
26 & 27 0.5 - 4.0 1.5  
27 & 28 0.5 - 4.0 1.5  
SOCKET-TO-GROUND: >1 MEGOHM

Yes

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

A (PG 2)

RECONNECT 1A6P1 AND PERFORM RUNNING-ENGINE FUNCTIONAL CHECK OF PMA, PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.B.4. USE MAINTENANCE TERMINAL TO MONITOR **CURRENT FAULTS**.

ANY PMA-RELATED FAULT INDICATIONS?

Yes

REPLACE PMA PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.A AND 1.B

B (PG 2)

PERFORM INTERMITTENT FAULT PROCEDURE (TASK 33)

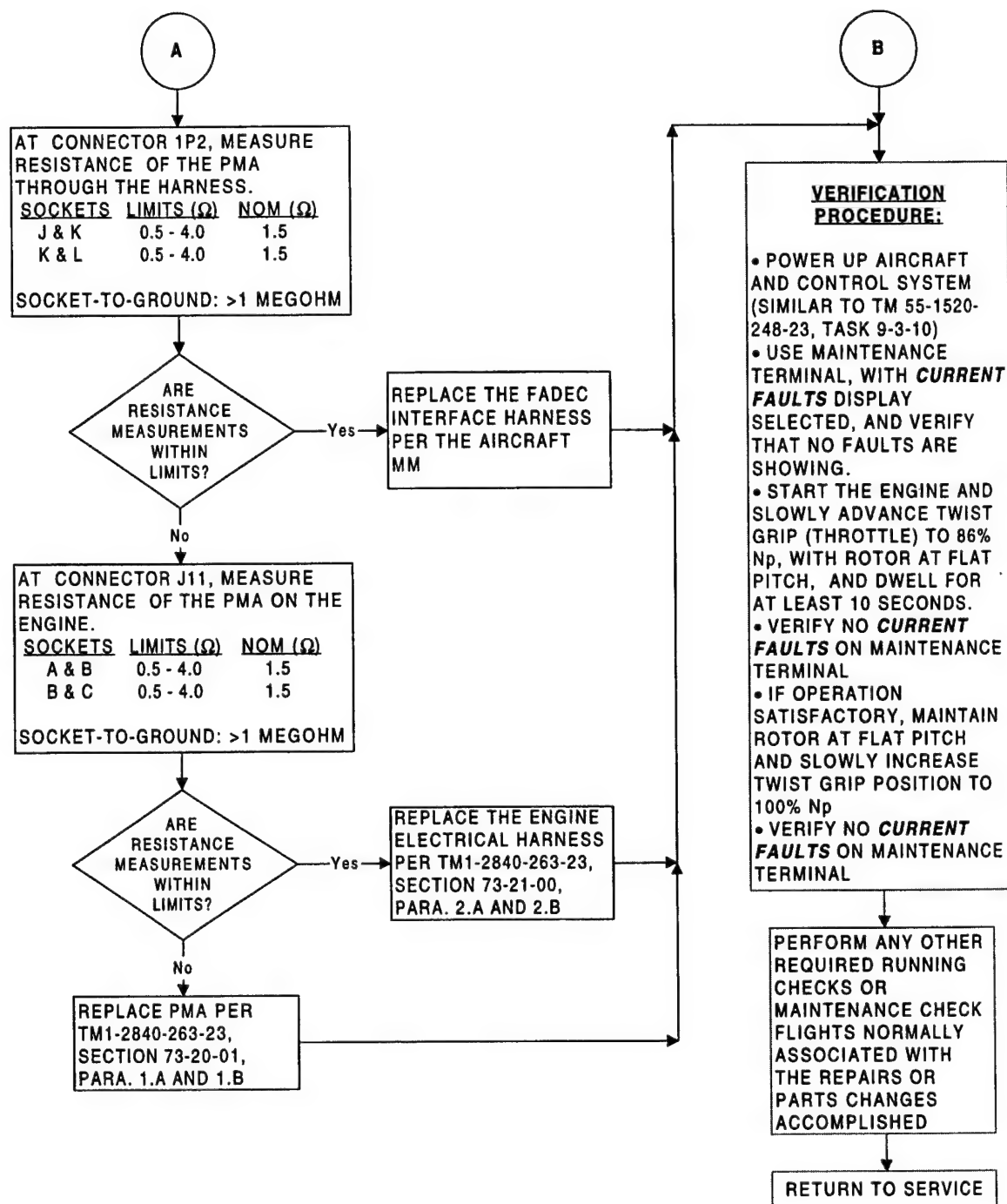
No

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE PMA (PER TM1-2840-263-23, SECTION 73-20-01, PARA. 1.A AND 1.B)

B (PG 2)

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**ASSOCIATED FAULT INDICATION(S):**  
QFit, QRgFit, QRtFit, QVidFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE TORQUE MEASUREMENT CIRCUIT OR A SIGNIFICANT SIGNAL ERROR

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR TMOP SENSOR LOOSE OR DAMAGED
- TMOP SENSOR FAILURE
- HARNESS FAILURE
- TORQUE PRESSURE PROBLEM IN ENGINE GEARBOX
- ECU FAILURE
- IN-RANGE T1 SIGNAL ERROR

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK **CURRENT** AND **LAST ENGINE RUN** FAULTS

IS FAULT CODE QVidFit INDICATED?

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

ISOLATE AND CORRECT CAUSE OF T1 SIGNAL ERROR, INCLUDING:

- INSPECTION OF T1 SENSOR INSTALLATION, SENSOR PLACEMENT, SENSOR PHYSICAL CONDITION
- SENSOR REPLACEMENT
- ECU REPLACEMENT

IS  $\Delta$  BETWEEN T1 AND OAT MORE THAN 10°F (5.6°C)?

- SELECT REAL TIME DATA - ANALOG PARAMETERS ON MAINTENANCE TERMINAL
- FACE AIRCRAFT INTO PREVAILING WIND
- OPERATE ENGINE AT 100% Np AND CHECK MAINTENANCE TERMINAL T1 INDICATION AGAINST AIRCRAFT OAT GAGE

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE TMOP SENSOR (PER TM1-2840-263-23, SECTION 77-15-01, PARA. 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

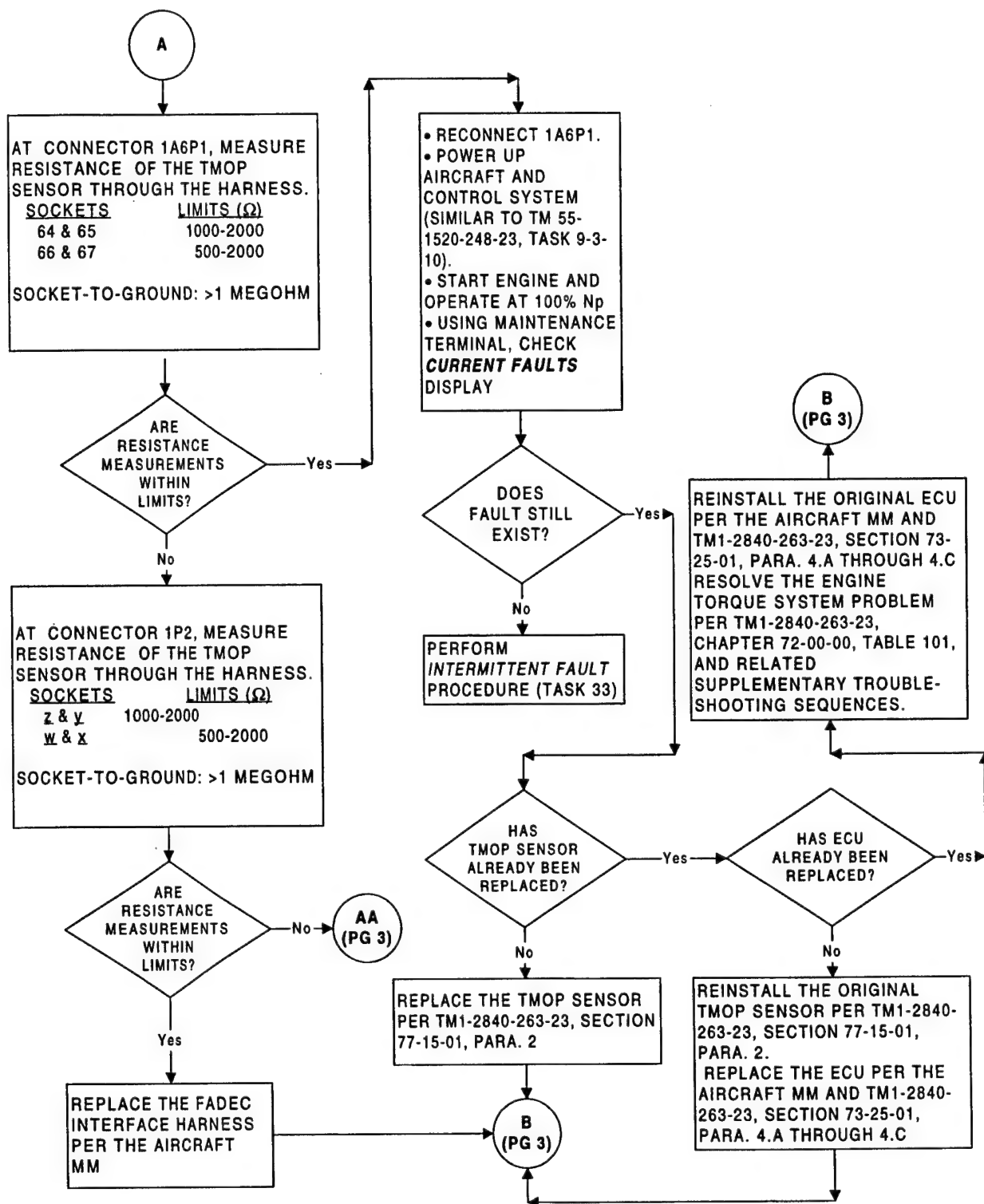
**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

B  
(PG 3)

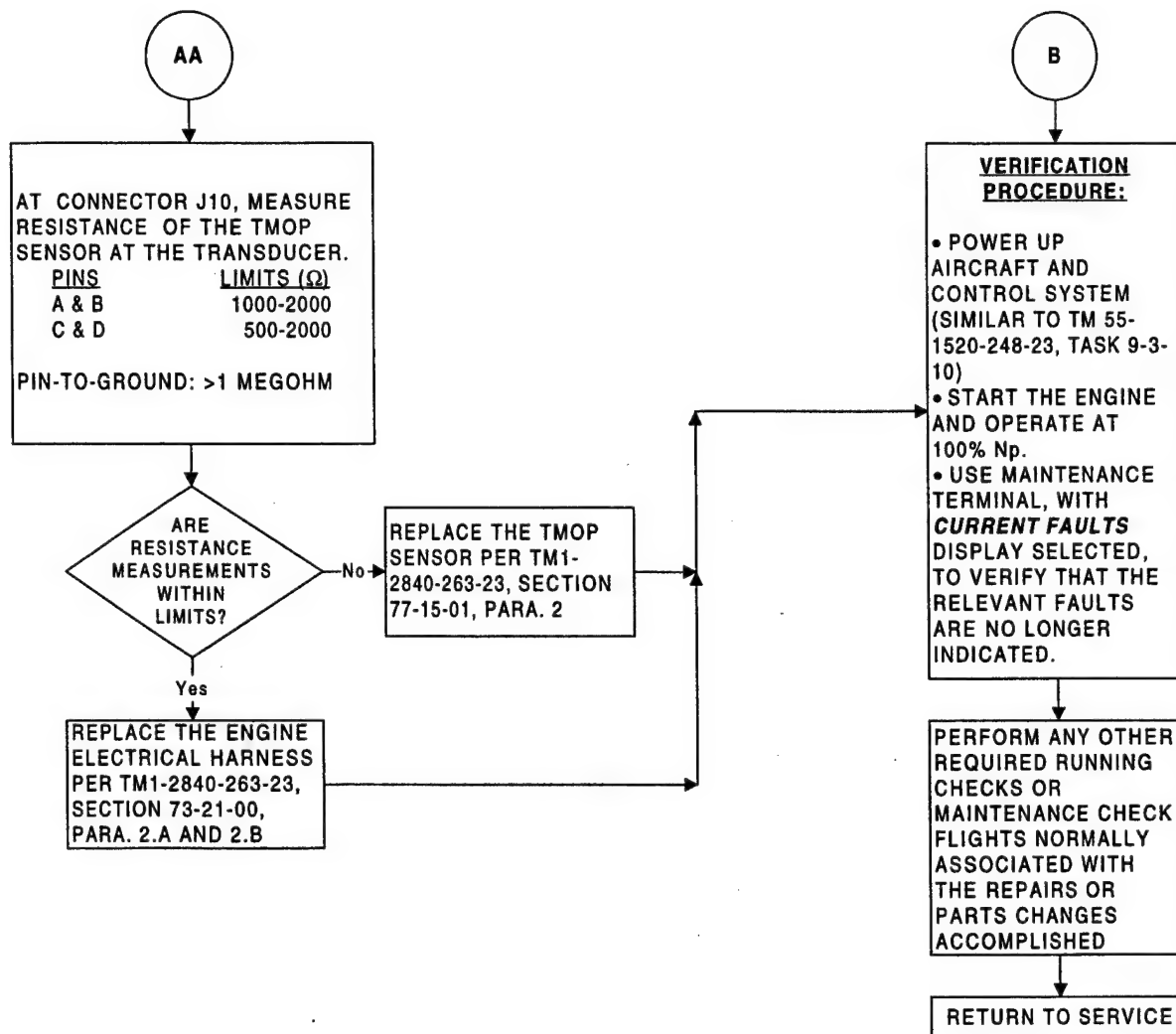
A  
(PG 2)

B  
(PG 3)

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**ASSOCIATED FAULT INDICATION(S):**

CPAntFlt, CPFIt, CPRgFlt

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/ COLLECTIVE PITCH POSITION POTENTIOMETER CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR CP POTENTIOMETER LOOSE OR DAMAGED
- CP POTENTIOMETER FAILURE
- AIRCRAFT COLLECTIVE PITCH POTENTIOMETER RIGGING EXCEEDS NORMAL TRAVEL LIMITS
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)
- SET COLLECTIVE PITCH LEVER TO ABOUT 50% (NEAR MID-TRAVEL) POSITION

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

D  
(PG 3)

AT CONNECTOR 1A6P2, MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS   LIMITS (Ω)   NOM (Ω)  
64 & 65   4250 - 5750   5000

-AND-

SUM OF RESISTANCE VALUES BETWEEN SOCKETS 63 & 65 AND BETWEEN SOCKETS 63 & 64 EQUAL TO OR GREATER THAN RESISTANCE BETWEEN SOCKETS 64 & 65

SOCKET-TO-GROUND: >1 MEGOHM

REPLACE (OR REPAIR) WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE INTERCONNECTING AIRCRAFT WIRING BETWEEN THE CP POTENTIOMETER AND THE ECU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
- THE ECU (PER THE AIRCRAFT MM AND TM 1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE CP POTENTIOMETER (SIMILAR TO TM 55-1520-248-23, TASK 11-2-1), AND RIG PER TM 1-2840-263-23

Yes

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

Yes

C  
(PG 2)

HOLD COLLECTIVE PITCH LEVER FULL DOWN AND MEASURE RESISTANCE OF THE POTENTIOMETER THROUGH THE HARNESS.

SOCKETS   LIMITS (Ω)   NOM (Ω)  
64 & 65   4250 - 5750   5000

63 & 65   700 - 1300   1000

63 & 64   3200 - 4900   4000

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

Yes

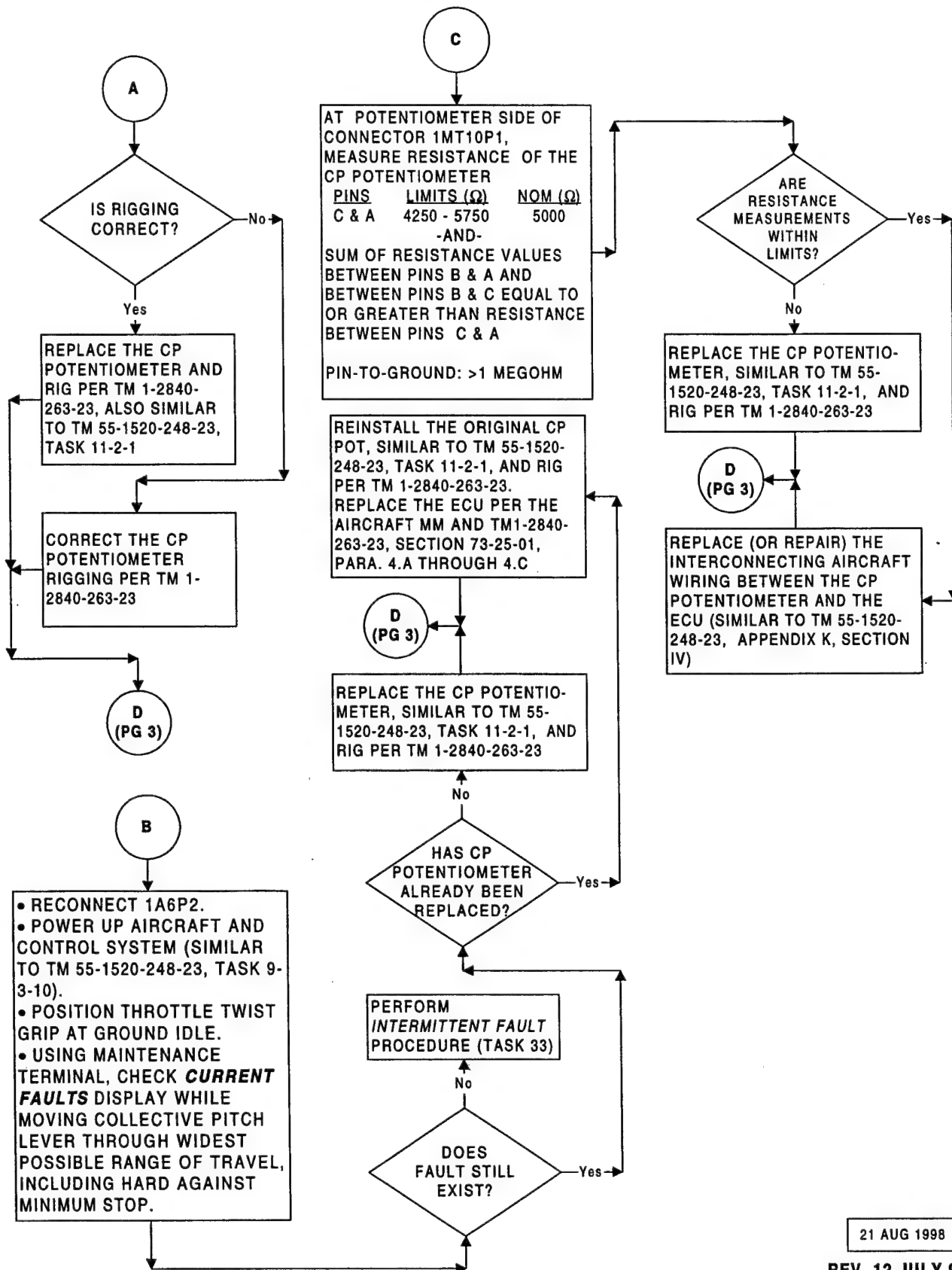
No

B  
(PG 2)

CHECK CP POTENTIOMETER RIGGING (RANGE OF MOTION AND POSITION ADJUSTMENTS) PER TM 1-2840-263-23, AND SIMILAR TO TM 55-1520-248-23, TASK 11-2-1

A  
(PG 2)

21 AUG 1998



21 AUG 1998

REV. 12 JULY 99





21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**NrAntDsb, NrCyFit, NrFit, NrRgFit,  
NrRtFit**DESCRIPTION:**THE ECU INDICATES A  
PROBLEM WITH THE ECU/  
Nr SPEED SENSOR  
CIRCUIT**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR Nr SENSOR LOOSE OR DAMAGED
- Nr SENSOR FAILURE
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO  
RESOLVE:DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-  
1520-248-23, TASK 9-3-  
11)**BEFORE**  
DISCONNECTING ANY  
CONNECTOR, FIRST  
CHECK FOR  
LOOSENESS AS  
POSSIBLE CAUSE OF  
FAULT.IS CONNECTOR  
TIGHT?TIGHTEN THE  
CONNECTOR,  
ENSURING PROPER  
KEYING BETWEEN THE  
MATING PLUG AND  
RECEPTACLE

Yes

No

RECONNECT 1A6P2.  
POWER UP AIRCRAFT AND  
CONTROL SYSTEM  
(SIMILAR TO TM 55-1520-  
248-23, TASK 9-3-10).  
USING MAINTENANCE  
TERMINAL, CHECK  
**CURRENT FAULTS**  
DISPLAY AFTER CYCLING  
FADEC POWER OFF AND  
ON (FADEC CIRCUIT  
BREAKER 1CB15)

Yes

ARE  
RESISTANCE  
MEASUREMENTS  
WITHIN  
LIMITS?

No

A  
(PG 2)AT CONNECTOR 1A6P2, MEASURE  
RESISTANCE OF THE Nr SENSOR  
ELEMENT THROUGH THE  
HARNESS.  

SOCKETS	LIMITS (Ω)	NOM (Ω)
29 & 30	800-1600	1200

  
SOCKET-TO-GROUND: >1 MEGOHM**AFTER**  
DISCONNECTING ANY  
CONNECTOR,  
IMMEDIATELY  
EXAMINE PINS AND  
SOCKETSARE PINS OR  
SOCKETS BENT,  
RECESSED OR  
MISSING?

Yes

No

REPLACE (OR REPAIR)  
WHICHEVER OF THE  
FOLLOWING ARE APPLICABLE:  

- THE AIRCRAFT WIRING HARNESS BETWEEN THE Nr SENSOR EXTENSION HARNESS AND THE ECU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
- THE Nr SENSOR EXTENSION HARNESS (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE Nr SENSOR (SIMILAR TO TM 55-1520-248-23)

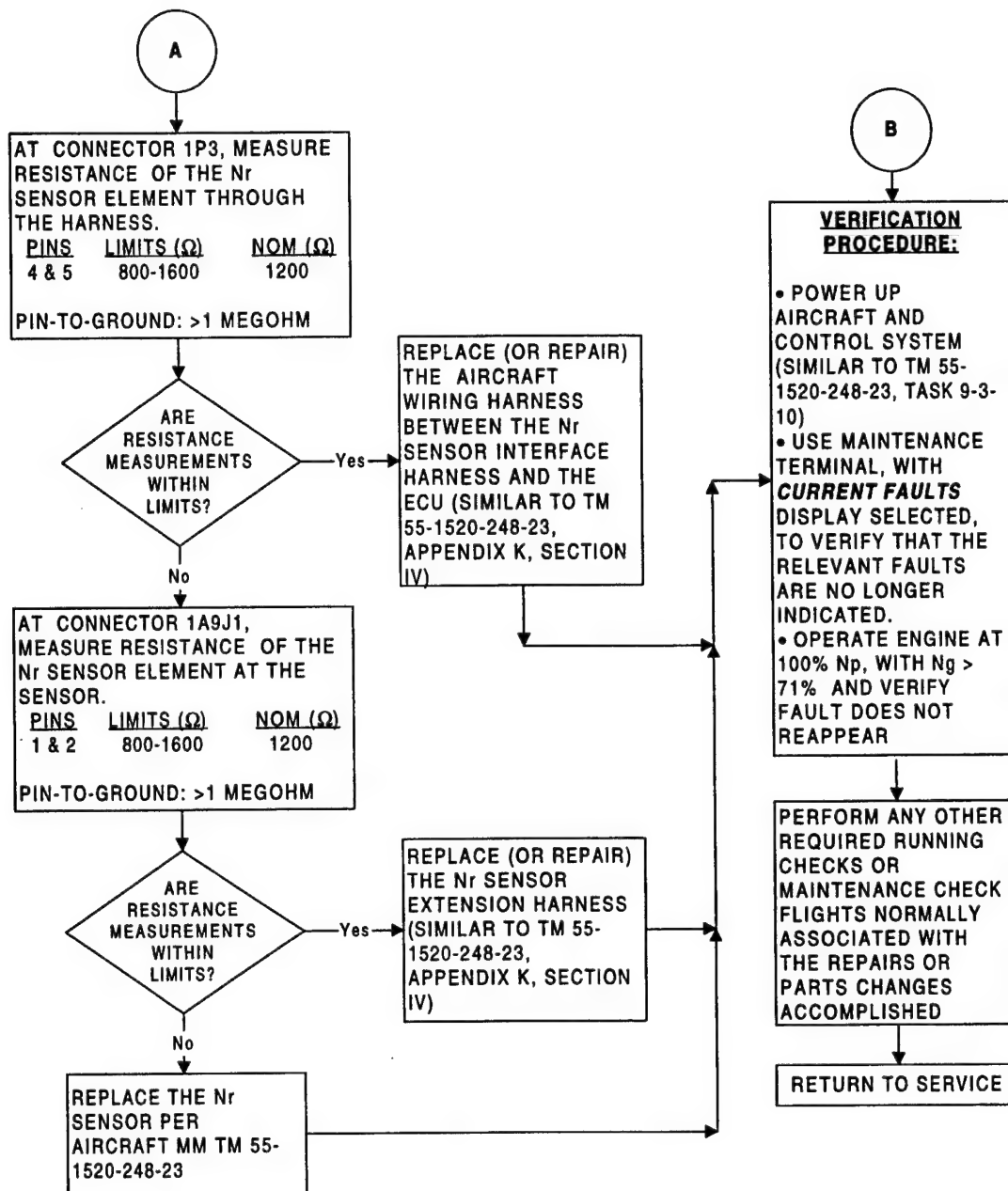
DOES  
FAULT STILL  
EXIST?

Yes

No

PERFORM  
INTERMITTENT FAULT  
PROCEDURE (TASK 33)REPLACE THE ECU PER THE  
AIRCRAFT MM AND TM1-2840-  
263-23, SECTION 73-25-01,  
PARA. 4.A THROUGH 4.CB  
(PG 2)B  
(PG 2)

08 SEP 1998



08 SEP 1998

**ASSOCIATED FAULT INDICATION(S):**  
P1Flt, P1HdFlt, P1RgFlt, P1RtFlt

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE P1 PRESSURE TRANSDUCER LOCATED WITHIN THE ECU

**POSSIBLE CAUSES:**

- TRANSDUCER FAILURE
- PLUGGED OR CLOGGED HOLES IN P1 SENSOR CAP

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

CHECK P1 CAP ON ECU FOR ANY VISIBLE DAMAGE.

IS CAP DAMAGED IN ANY WAY?

Yes

No

CHECK HOLES IN P1 CAP ON ECU FOR BLOCKAGE BY FOREIGN OBJECTS OR CONTAMINATION

ARE CAP HOLES BLOCKED?

No

Yes

REPLACE THE ECU PER THE AIRCRAFT MM AND TM 1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

CLEAR BLOCKAGE FROM THE HOLES

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% N<sub>p</sub> AND VERIFY FAULT DOES NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**

AD12BitFit, AD8BitFit, ARINCHWFit, BacCompFit, BVIFit, CJCFit, CJCRgFit, CJCRtFit, ECUOTFit, EECaIFit, EEHistFit, EEPROMFit, ForCompFit, GainFit, GainRgFit, HLRfFit, HLRfRgFit, IgnFit, Not Used, OffsFit, OffsRgFit, OrDiodeFit, OSVFit, OSVRgFit, PROMFit, PW10Fit, PW10RgFit, RAMFit, StrFit, SWIntFit, UARTFit, UUIntFit, V15Fit, V15RgFit, V5Fit, V5RgFit, WDTFit, WDTOutFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM INTERNAL TO THE ECU

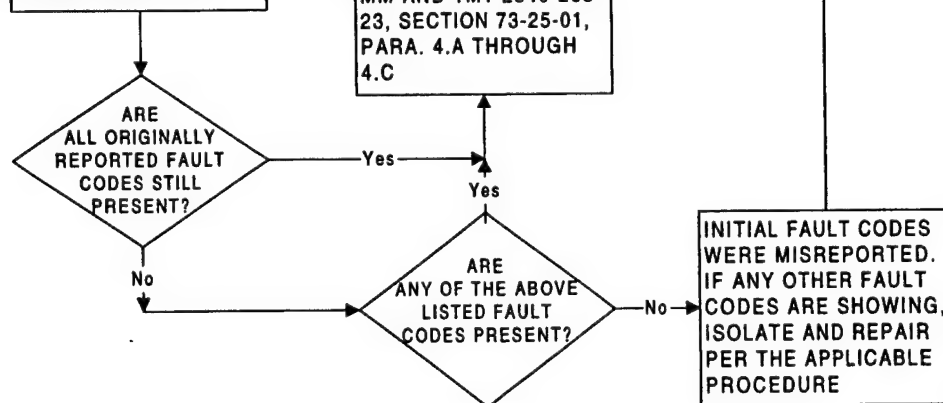
**POSSIBLE CAUSES:**

- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

**NOTE: DO NOT START ENGINE UNTIL THIS STEP IS PERFORMED:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** AND **LAST ENGINE RUN FAULTS** DISPLAYS AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
- TABULATE FAULT CODES DISPLAYED

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- USE MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED, TO VERIFY THAT THE RELEVANT FAULTS ARE NO LONGER INDICATED.
- OPERATE ENGINE AT 100% Np AND VERIFY FAULTS DO NOT REAPPEAR

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**

AF28Fit, AF28RgFit,

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE AIRFRAME 28VDC SUPPLY TO THE ECU

**POSSIBLE CAUSES:**

- WEAK BATTERY, POWER INTERRUPTS, OR AIRFRAME 28VDC SUPPLY FAILURE
- MATING CONNECTORS ON ECU OR HARNESSES LOOSE OR DAMAGED
- POOR AIRCRAFT GROUND PATH
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

REVIEW RECENT HISTORY AND CURRENT SITUATION FOR EVIDENCE OF WEAK BATTERY, POWER INTERRUPTS, OR OVER/UNDER VOLTAGES

EVIDENCE OF AIRCRAFT ELECTRICAL POWER PROBLEM?

Yes

INSPECT AND TROUBLESHOOT THE BATTERY AND AIRCRAFT 28VDC SUPPLY, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

DISCONNECT 1A6P1 AND 1A6P2 CONNECTORS. MEASURE RESISTANCE FROM ECU CASE TO AIRFRAME GROUND AT BATTERY

IS RESISTANCE LESS THAN ONE OHM?

Yes

No

A  
(PG 2)

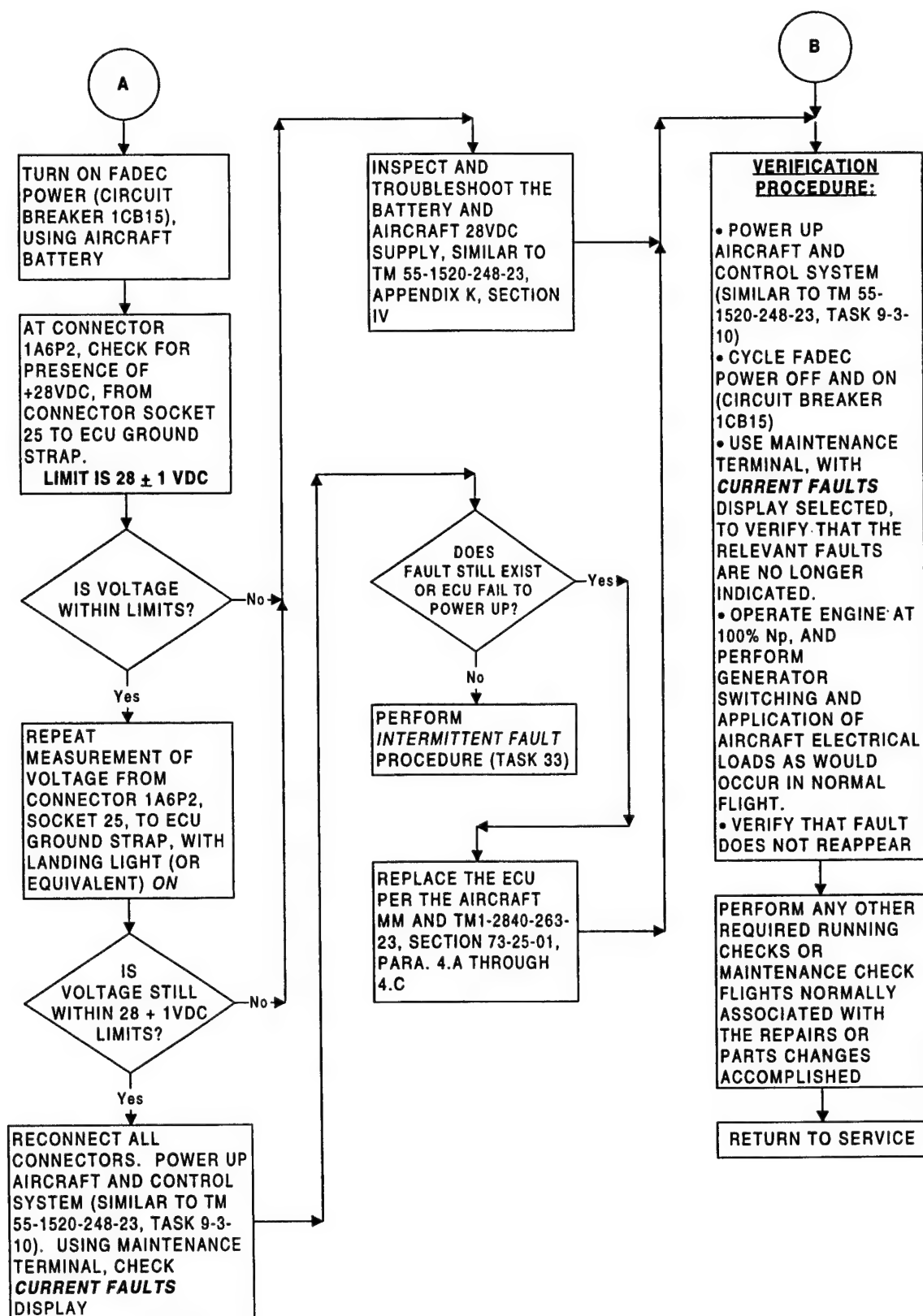
CORRECT ECU GROUNDING TO AIRFRAME

B  
(PG 2)

DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV - OR - REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

B  
(PG 2)

21 AUG 1998



21 AUG 1998

# 18. OVERSPEED SYSTEM PUSH-TO-TEST SWITCH CIRCUIT FAULT

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
OSTstSwFit

## **DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/ OVERSPEED PUSH-TO-TEST SWITCH CIRCUIT

## **POSSIBLE CAUSES:**

- SWITCH FAILURE OR SWITCH HELD ON FOR MORE THAN 30 SECONDS
- MATING CONNECTORS ON ECU, HARNESSES, OR MCPU LOOSE OR DAMAGED
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

HAS SWITCH BEEN HELD ON FOR MORE THAN 30 SECONDS?

Yes

THERE IS NO PROBLEM. CHANGE OPERATING PROCEDURE TO ASSURE OVERSPEED SYSTEM FUNCTIONAL TEST IS COMPLETED WITHIN 30 SECONDS OF DEPRESSING SWITCH.

RETURN TO SERVICE

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B (PG 2)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

AT CONNECTOR 1A6P2, SOCKET 44, MEASURE SWITCH RESISTANCE TO GROUND THROUGH THE HARNESS.

SWITCH POSITION	LIMITS ( $\Omega$ )
OVERSPEED TEST	<1
NORMAL (NO TEST)	>100K

ARE MEASUREMENTS WITHIN LIMITS?

No

Yes

A (PG 2)

- TROUBLE SHOOT THE OVERSPEED SYSTEM PUSH-TO-TEST SWITCH IN THE LEFT MCPU (ON MFD BEZEL) AND/OR
- REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS BETWEEN THE ECU AND THE COCKPIT LEFT MCPU (OR ASSOCIATED MFD UNIT), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

B (PG 2)

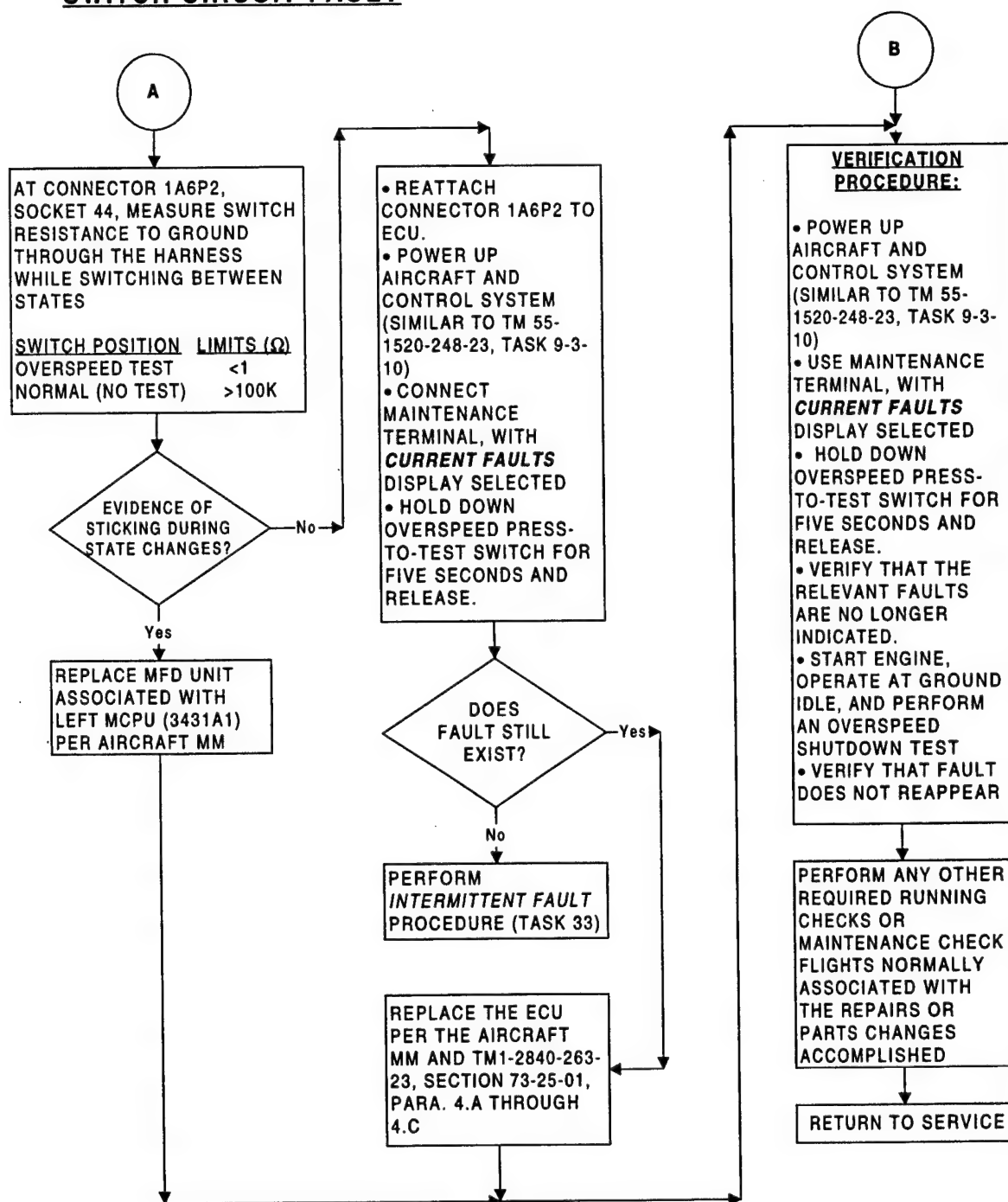
DEPENDING UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU, OR THE COCKPIT LEFT MCPU SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV  
- OR -  
REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

21 AUG 1998



# 18. OVERSPEED SYSTEM PUSH-TO-TEST SWITCH CIRCUIT FAULT

Page 2 of 2



21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**  
AMSWFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/FADEC MODE SWITCH CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES, OR COCKPIT INSTRUMENT PANEL LOOSE OR DAMAGED
- SWITCH FAILURE
- ECU FAILURE
- HARNESS FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

RECONNECT 1A6P2. POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER SWITCHING FROM AUTO TO MANUAL TO AUTO

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

AT CONNECTOR 1A6P2, MEASURE SWITCH RESISTANCE TO GROUND THROUGH THE HARNESS.

SWITCH POS	SOCKET	LIMITS ( $\Omega$ )
AUTO	45	<1
AUTO	49	>100K
AUTO	12	>100K
MANUAL	45	>100K
MANUAL	49	<1
MANUAL	12	<1

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

DOES FAULT STILL EXIST?

PERFORM  
INTERMITTENT FAULT  
PROCEDURE (TASK 33)

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

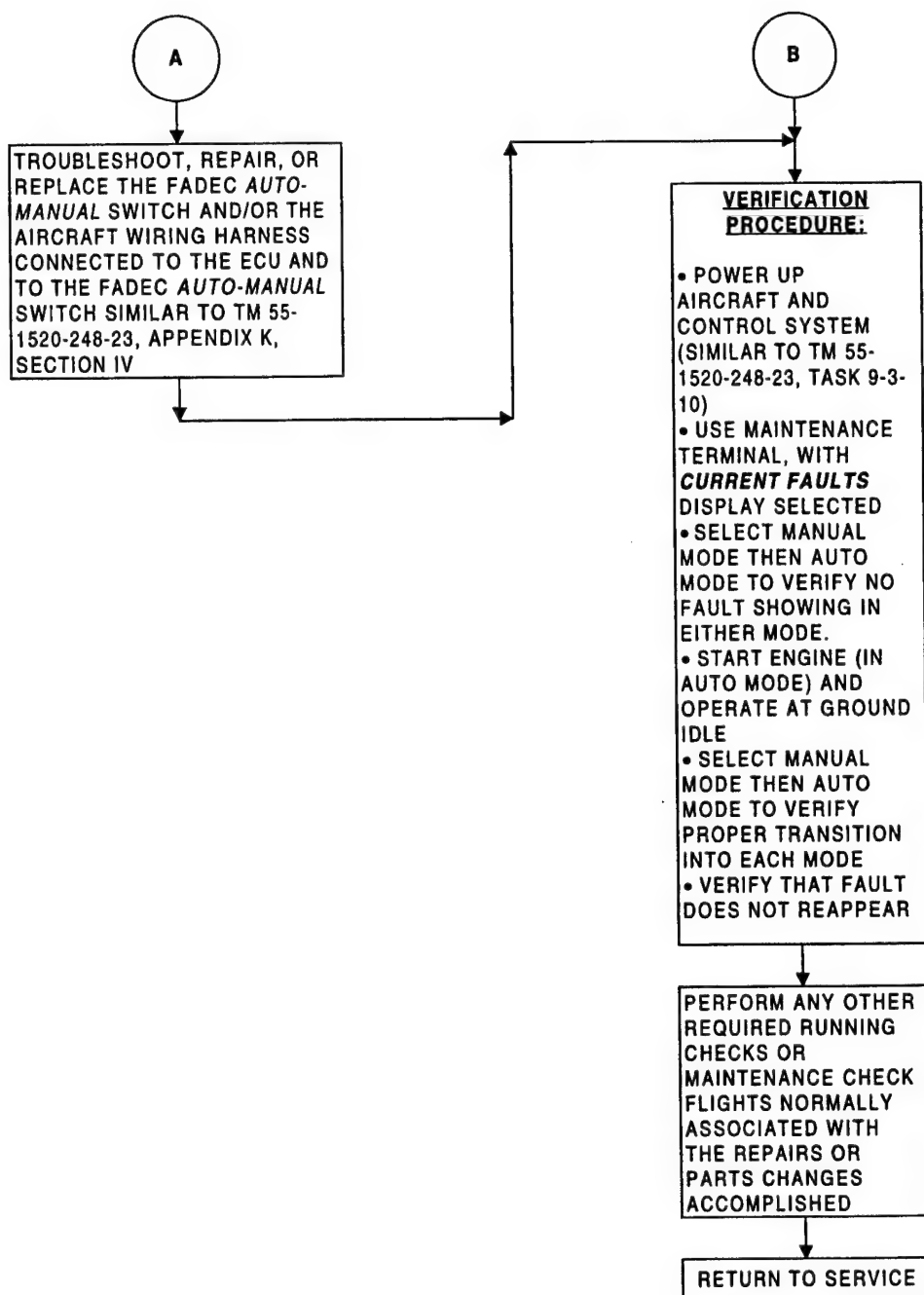
DEPENDING UPON FINDINGS:  
REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE COCKPIT FADEC AUTO-MANUAL SWITCH  
SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV  
- OR -  
REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

B  
(PG 2)

A  
(PG 2)

B  
(PG 2)

21 AUG 1998



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**ASSOCIATED FAULT INDICATION(S):**  
IgnIFlt

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE IGNITION CIRCUIT

**POSSIBLE CAUSES:**

- RELAY OR SWITCH FAILURE IN AIRCRAFT IGNITION CIRCUIT
- MATING CONNECTORS ON ECU OR AIRCRAFT HARNESSES LOOSE OR DAMAGED
- HARNESS FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER CYCLING ECU POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

DOES FAULT STILL EXIST?

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

C  
(PG 2)

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
(PG 2)

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

- DISCONNECT AIRCRAFT HARNESS CONNECTOR 1A6P2 FROM ECU
- CONNECT A JUMPER WIRE FROM SOCKET NO. 7 OF 1A6P2 TO AIRCRAFT GROUND
- PLACE TWIST GRIP IN CUTOFF POSITION AND POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11).

IGNITION SYSTEM SHOULD ACTIVATE

DID IGNITION SYSTEM ACTIVATE?

No

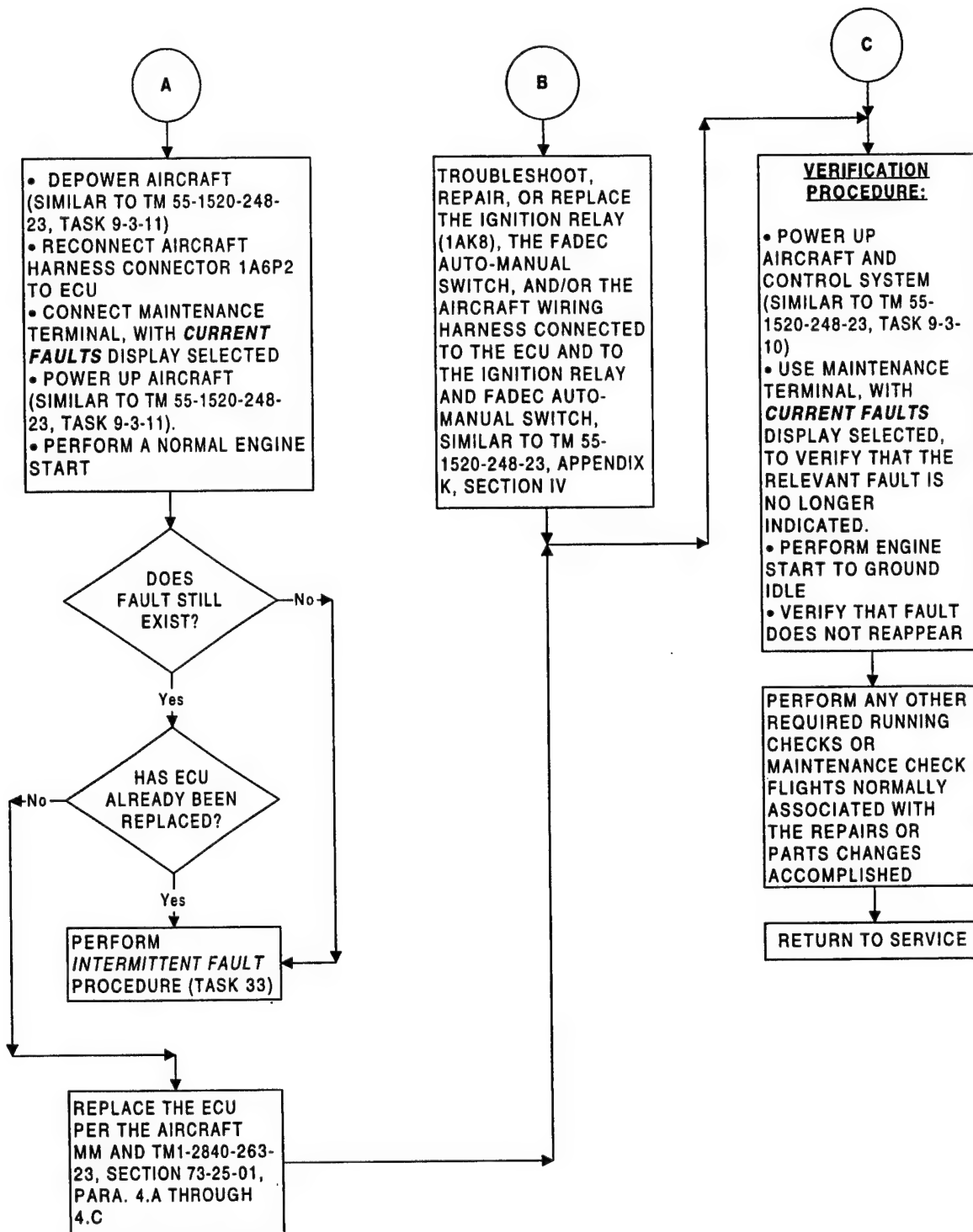
B  
(PG 2)

A  
(PG 2)

C  
(PG 2)

DEPENDENT UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS AT ECU (CONNECTOR 1A6P2) SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV  
- OR -  
REPLACE THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

21 AUG 1998



21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**  
StepCntFit, WfStFit, WfStRgFit

**DESCRIPTION:**

METERING VALVE POSITION FEEDBACK SIGNAL NOT IN AGREEMENT WITH ECU-COMMANDED POSITION, OR THE STEPPER MOTOR POSITION IS OUT OF RANGE

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE
- HMU METERING VALVE, STEPPER MOTOR, OR FEEDBACK POTENTIOMETER IN-RANGE FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE

IS FAULT CODE *SmFit* INDICATED?

Yes

PERFORM TASK 1

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**

DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

C (PG 2)

21 AUG 1998

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF EACH OF 4 STEPPER MOTOR WINDINGS THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
1 & 5	20- 40	30
2 & 5	20- 40	30
3 & 5	20- 40	30
4 & 5	20- 40	30

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

No

A (PG 2)

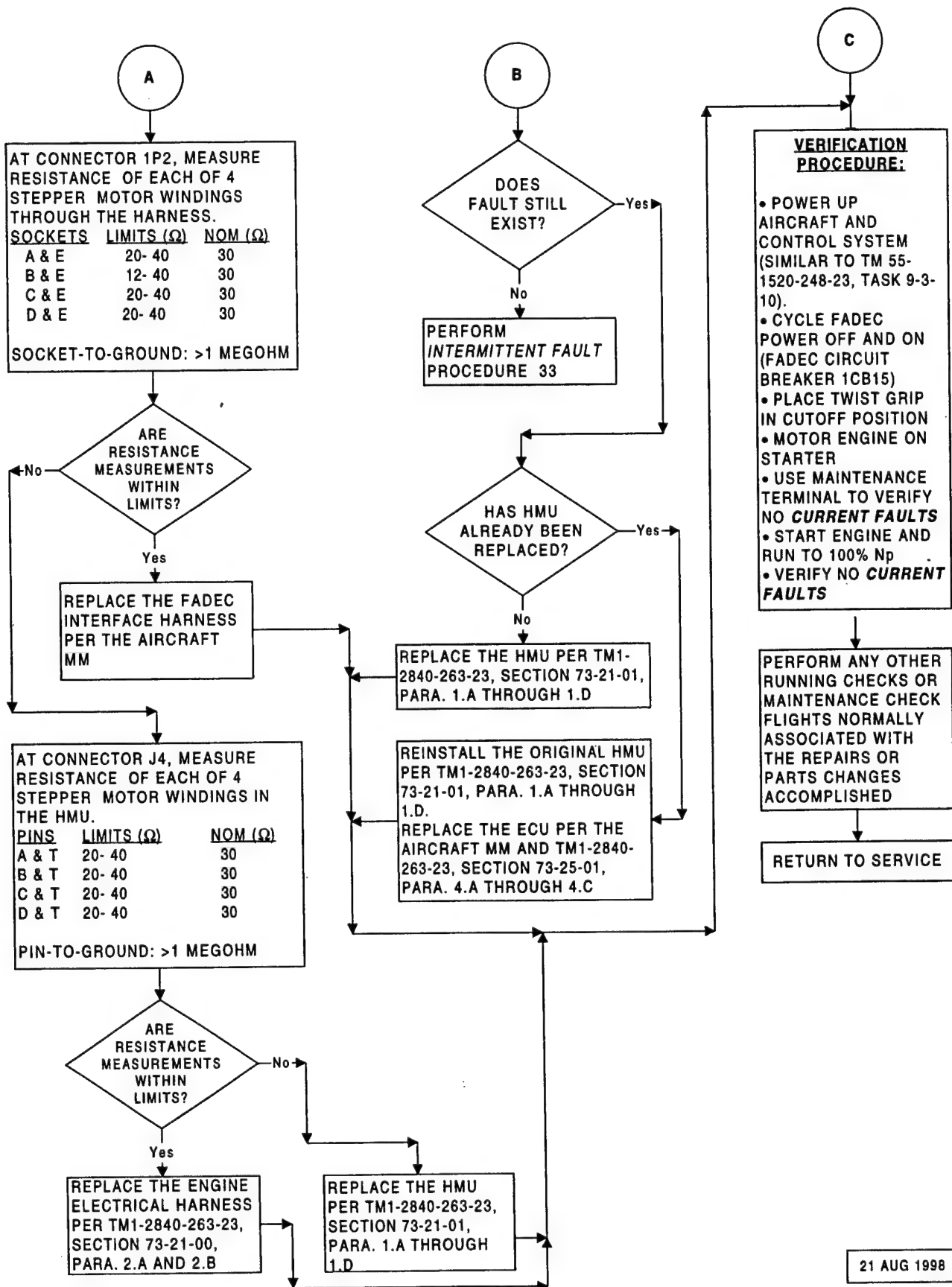
Yes

- RECONNECT 1A6P1
- PLACE TWIST GRIP IN CUTOFF POSITION
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
- MOTOR ENGINE ON STARTER
- USE MAINTENANCE TERMINAL TO CHECK **CURRENT FAULTS**
- IF NO FAULTS START ENGINE AND RUN TO 100% Np

B (PG 2)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)



21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**  
OpenMvFlg

**DESCRIPTION:**  
HMU METERING VALVE IS OPEN PRIOR TO ENGINE START

**POSSIBLE CAUSES:**

- AIRCRAFT BATTERY TURNED OFF AT SHUTDOWN, BEFORE ENGINE STOPPED ROTATING
- THROTTLE OPENED AT SHUTDOWN, BEFORE ENGINE STOPPED ROTATING
- ENGINE WAS NOT SHUT DOWN USING NORMAL SHUTDOWN PROCEDURES
- NEWLY INSTALLED HMU WAS NOT MOTORED WITH THROTTLE IN CUTOFF POSITION
- HMU METERING VALVE WAS NOT CLOSING PROPERLY, OR SPRINGING OPEN AFTER POWERDOWN
- HMU POTENTIOMETER MISADJUSTED OR FAILED IN-RANGE

PROCEED AS FOLLOWS TO RESOLVE:

PERFORM HMU PISTON PARKING PROCEDURE PER TM1-2840-263-23, SECTION 73-21-01, PARA.1.B.(12)

• POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)

• CONNECT MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED, AND CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

• WITH CONTROL SYSTEM IN **AUTO** MODE, VERIFY NO **CURRENT FAULTS** SHOWING

DOES FAULT STILL EXIST?

RETURN TO SERVICE

REPLACE THE HMU PER TM1-2840-263-23 SECTION 73-21-01, PARA. 1.A THROUGH 1.D

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CONNECT MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED, AND CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
- WITH CONTROL SYSTEM IN **AUTO** MODE, VERIFY NO **CURRENT FAULTS** SHOWING

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998



**ASSOCIATED FAULT INDICATION(S):**  
OSTstFit

**DESCRIPTION:**  
THE ECU INDICATES A PROBLEM WITH THE OVERSPEED SYSTEM DURING ENGINE SHUTDOWN TEST

**POSSIBLE CAUSES:**

- HMU OVERSPEED SHUT OFF SOLENOID FAILURE
- ECU FAILURE
- MATING CONNECTORS ON ECU, HARNESSES OR HMU LOOSE OR DAMAGED
- HARNESS FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

CONNECT MAINTENANCE TERMINAL AND CHECK CURRENT AND LAST ENGINE RUN FAULTS

IS FAULT CODE *NpOSFit* INDICATED?

PERFORM TASK 24

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
(PG 3)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

Yes

No

Yes

Yes

AT CONNECTOR 1A6P1, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
35 & 45	21-45	30
34 & 46	21-45	30

SOCKET-TO-GROUND: >1 MEGOHM

ARE RESISTANCE MEASUREMENTS WITHIN LIMITS?

B  
(PG 2)

No

AT CONNECTOR 1P2, MEASURE RESISTANCE OF THE SOLENOID WINDING THROUGH THE HARNESS.

SOCKETS	LIMITS (Ω)	NOM (Ω)
H & M	21-45	30
N & b	21-45	30

SOCKET-TO-GROUND: >1 MEGOHM

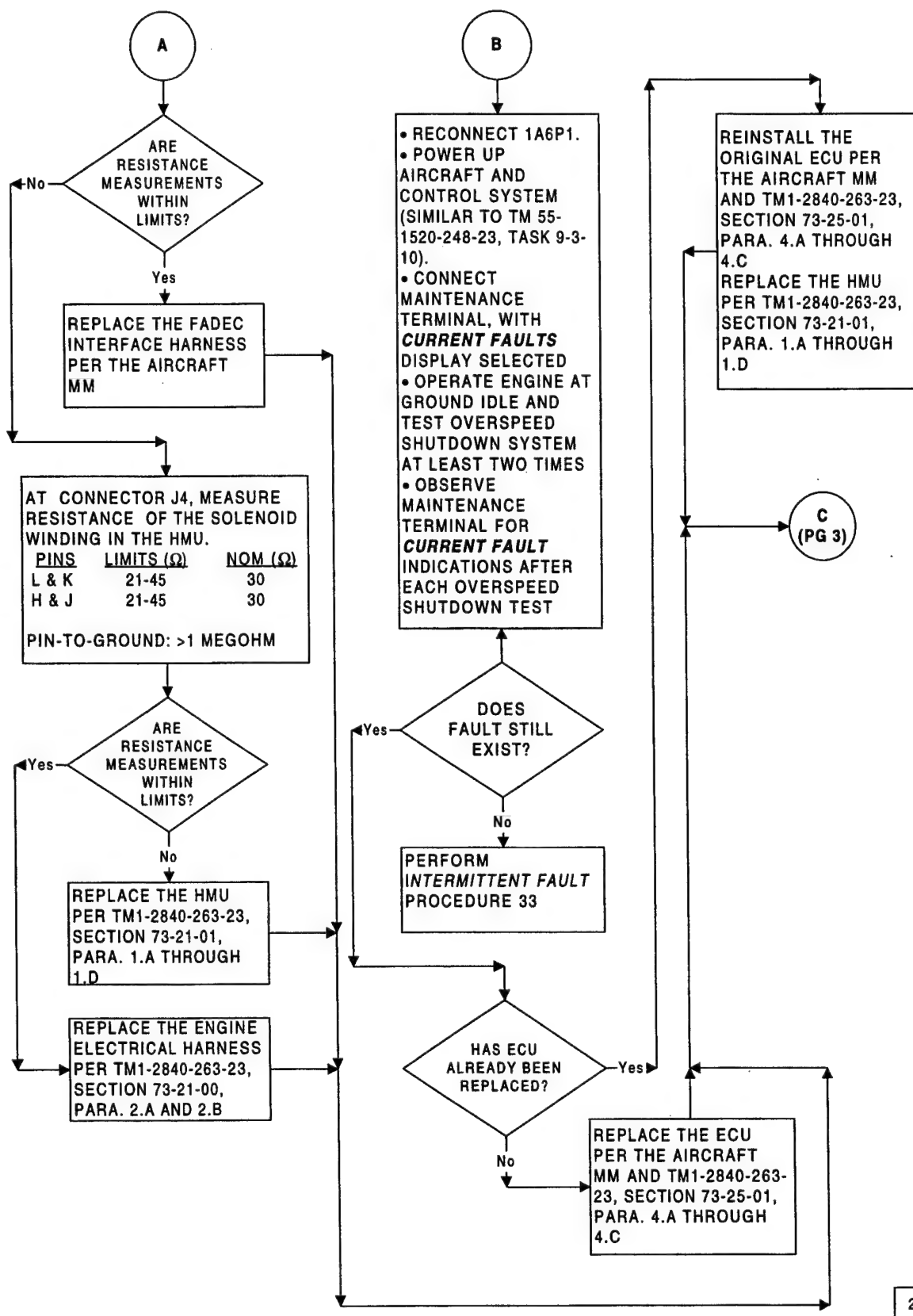
A  
(PG 2)

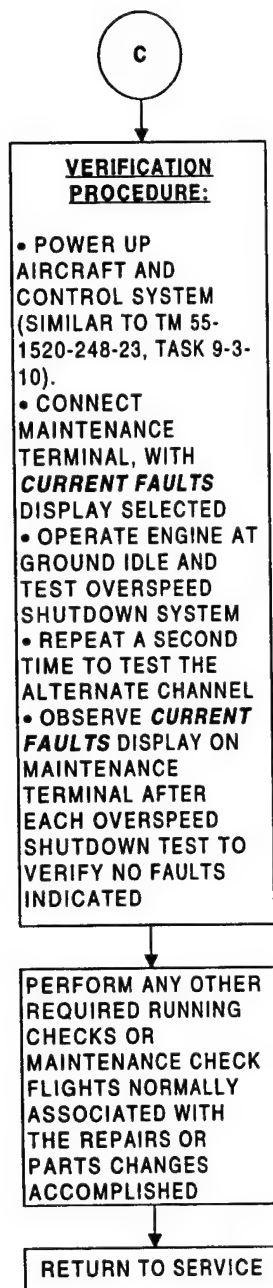
C  
(PG 3)

REPLACE WHICHEVER OF THE FOLLOWING ARE APPLICABLE:

- THE FADEC INTERFACE HARNESS (PER THE AIRCRAFT MM)
- THE ENGINE ELECTRICAL HARNESS (PER TM1-2840-263-23, SECTION 73-21-00, PARA. 2.A AND 2.B)
- THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)
- THE HMU (PER TM1-2840-263-23, SECTION 73-21-01, PARA. 1.A THROUGH 1.D)

21 AUG 1998

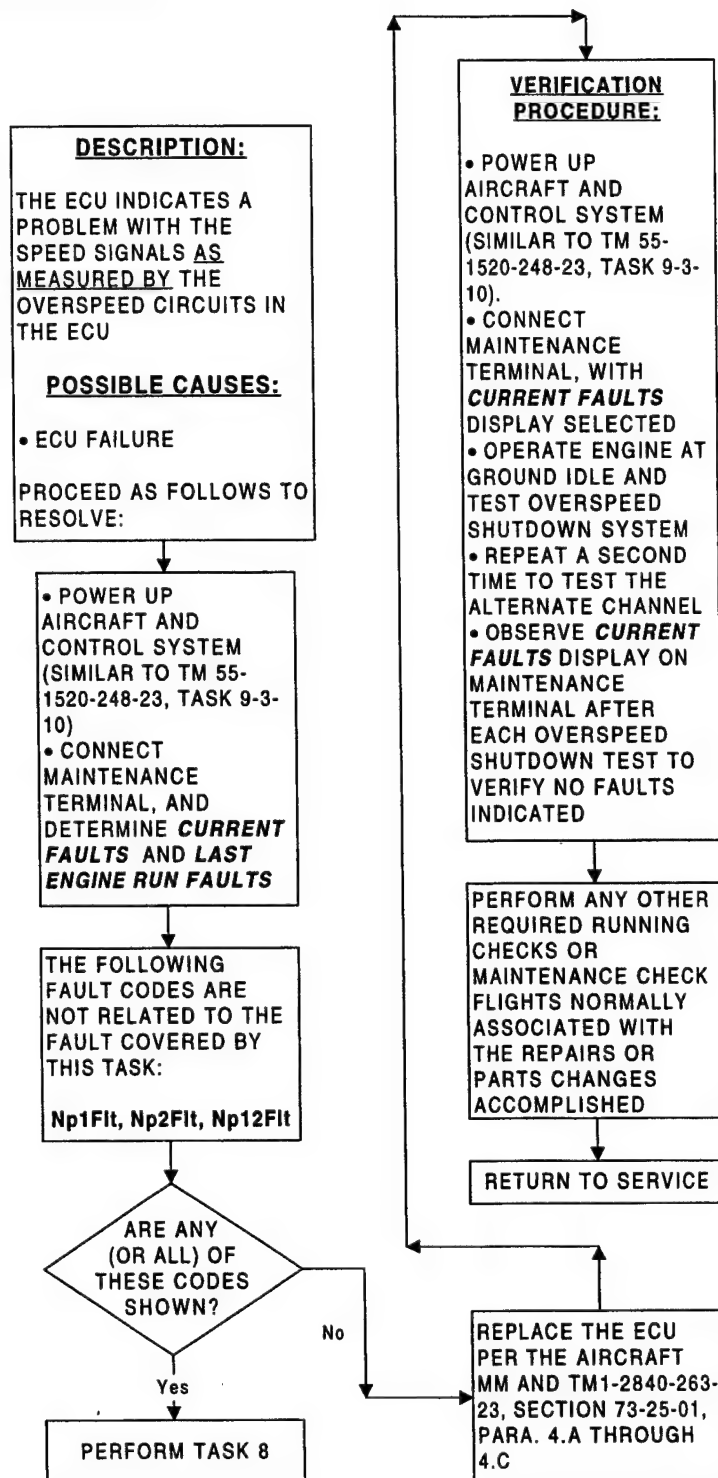




21 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**

NpOSFit

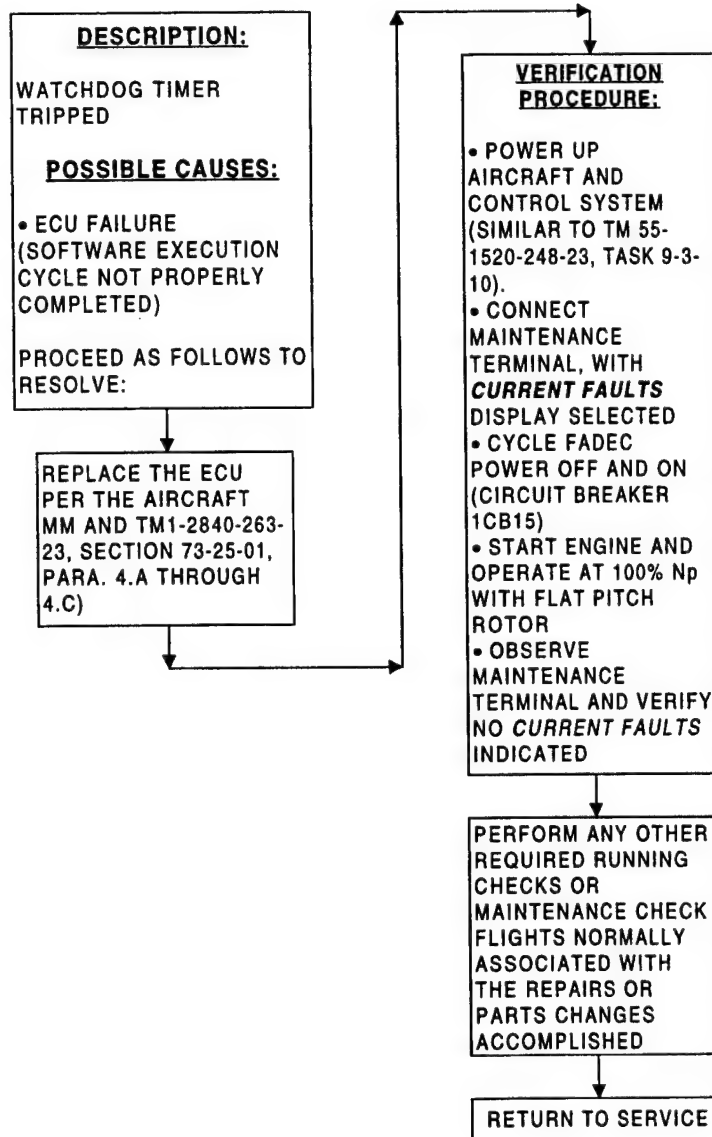


21 AUG 1998

## 25. WATCHDOG TIMER HARD FAULT

Page 1 of 1

**ASSOCIATED FAULT INDICATION(S):**  
WDTTimeOut



21 AUG 1998

**MOST LIKELY FAULT INDICATION:**

TestCelFit

**DESCRIPTION:**

THE ECU INCORRECTLY INDICATES THAT AN UNUSED DISCRETE INPUT SIGNAL IS ACTIVE (SHORTED TO GROUND)

**POSSIBLE CAUSES:**

- MATING CONNECTOR ON ECU OR HARNESS DAMAGED
- INCORRECT HARNESS INSTALLED

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

Yes

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

AT CONNECTOR 1A6P2, MEASURE RESISTANCE TO GROUND THROUGH THE HARNESS AT SOCKET 58. (IF NO SOCKET INSTALLED NO MEASUREMENT REQUIRED)  
**LIMIT >1 MEGΩ NOMINAL OPEN**

IS SOCKET INSTALLED?

Yes

Yes

No

REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

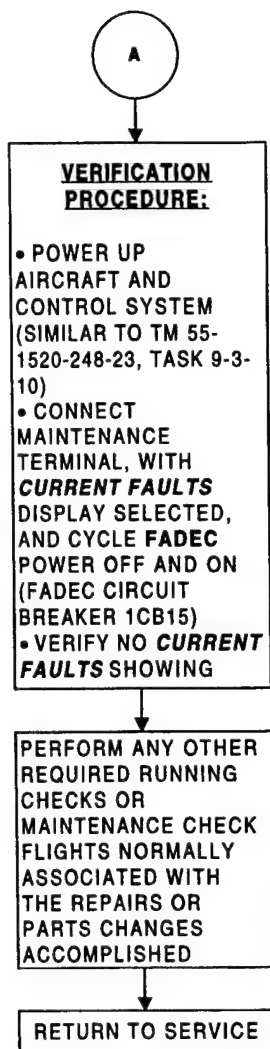
REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

DEPENDENT UPON FINDINGS:  
REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV  
- OR -  
REPLACE THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

A  
(PG 2)

A  
(PG 2)

21 AUG 1998



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**ASSOCIATED FAULT INDICATION(S):**

ARINCFItAn, CPDFIt, FTempFit, LoadSelFit,  
LoadSHdFit, NgOFIt, NgORgFit, NgORtFit,  
Not Used, NrDFIt, P1DFIt,

**DESCRIPTION:**

THE ECU INDICATES  
FAULT CODES THAT ARE  
NOT VALID FOR THIS  
INSTALLATION

**POSSIBLE CAUSES:**

- INSTALLED ECU IS NOT CORRECT CONFIGURATION
- MAINTENANCE TERMINAL DATA FILES CORRUPTED OR WRONG CONFIGURATION
- ECU FAILURE

PROCEED AS FOLLOWS TO  
RESOLVE:

CHECK PART NUMBER  
OF INSTALLED ECU TO  
VERIFY IT IS CORRECT

IS  
ECU PART  
NUMBER  
CORRECT?

No

REPLACE THE ECU  
PER THE AIRCRAFT  
MM AND TM1-2840-263-  
23, SECTION 73-25-01,  
PARA. 4.A THROUGH  
4.C

- RELOAD MAINTENANCE TERMINAL DATA FILES INTO MAINTENANCE TERMINAL USING KNOWN GOOD DISKS
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- CONNECT MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED
- CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

DO  
INCORRECT  
FAULTS STILL  
EXIST?

Yes

No

PROBLEM RESOLVED -  
RETURN TO SERVICE

**VERIFICATION  
PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10).
- CONNECT MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED
- CYCLE FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)
- OBSERVE MAINTENANCE TERMINAL AND VERIFY NO **CURRENT FAULTS** INDICATED

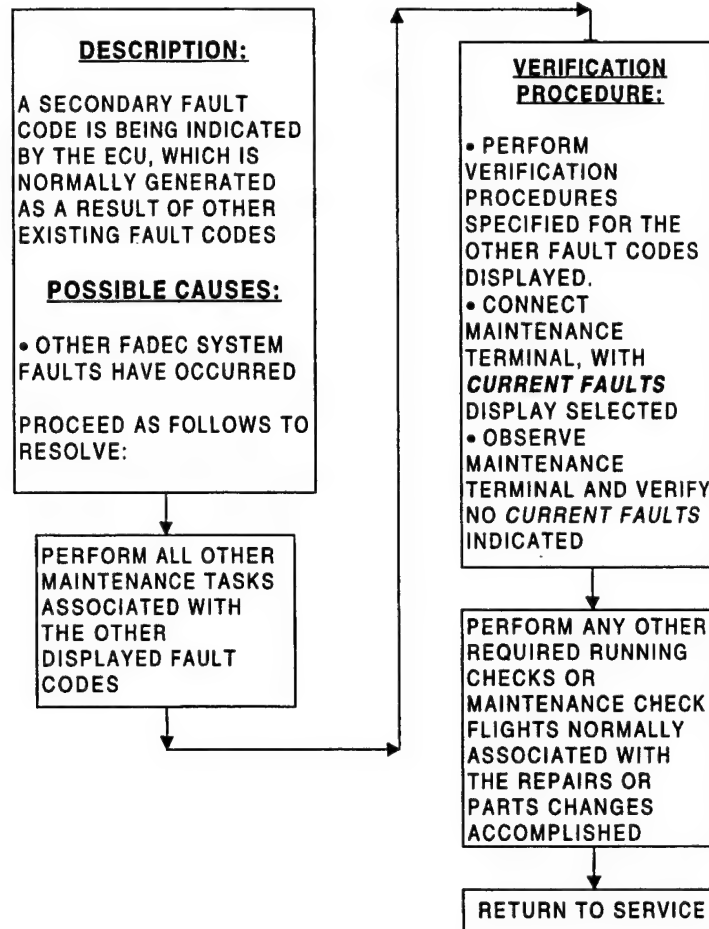
PERFORM ANY OTHER  
REQUIRED RUNNING  
CHECKS OR  
MAINTENANCE CHECK  
FLIGHTS NORMALLY  
ASSOCIATED WITH  
THE REPAIRS OR  
PARTS CHANGES  
ACCOMPLISHED

RETURN TO SERVICE

21 AUG 1998



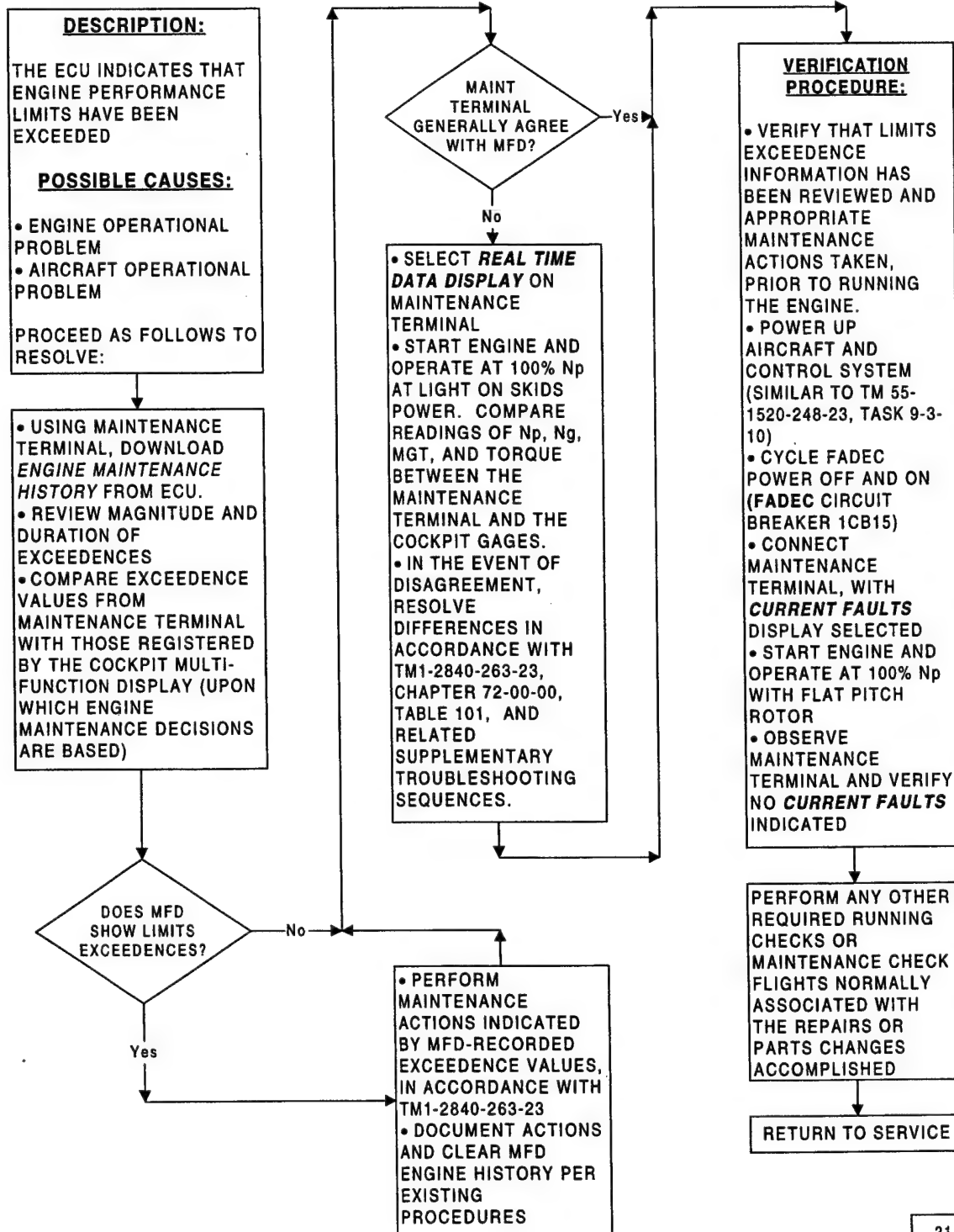
**ASSOCIATED FAULT INDICATION(S):**  
AMFlt, HardFlt, Or28Flt, Or28RgFlt,  
OSFlt, TempFlt, WfHdFlt,



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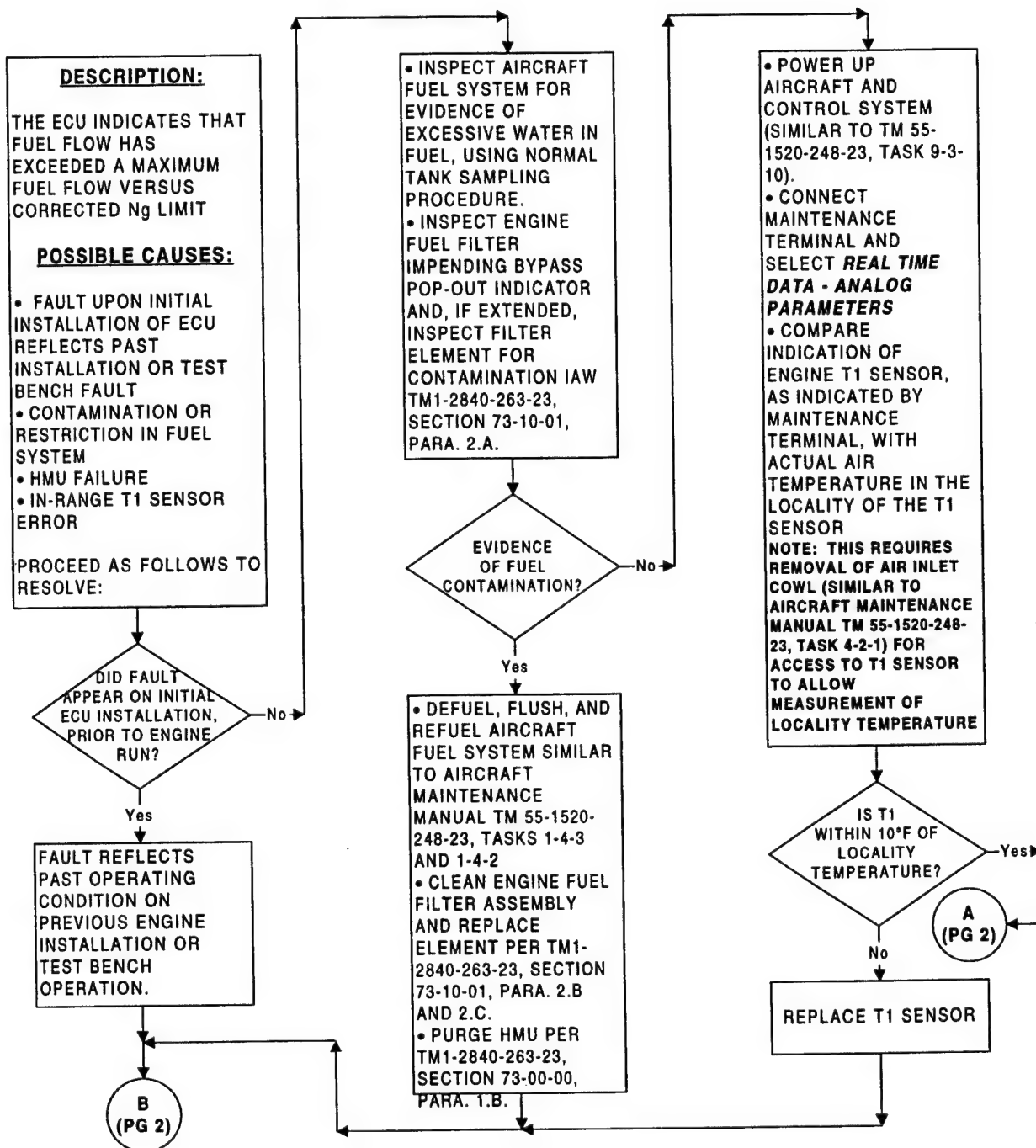
**ASSOCIATED FAULT INDICATION(S):**

MGTLmTOut, MGTRLmTOut, MGTSLmTOut, MGTSRLmTOut,  
NgLmTOut, NgRLmTOut, NpLmTOut, NpQExLmAdv,  
NpQRnLmAdv, OSFlag, QLmTOut, QRLmTOut,

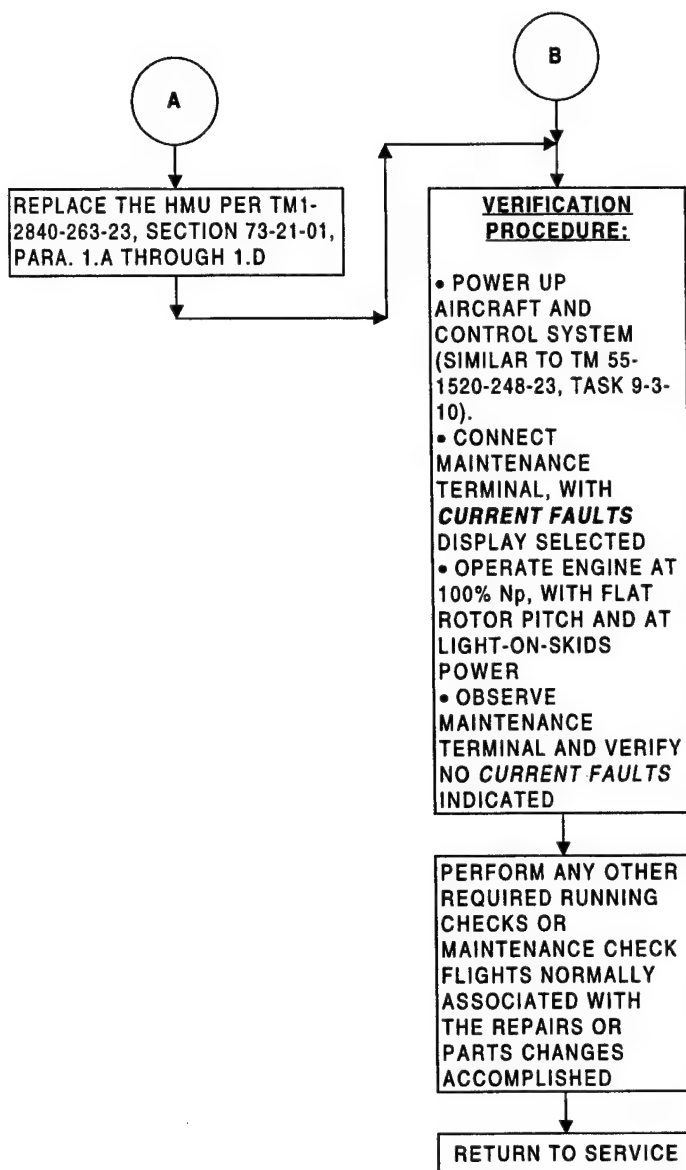


21 AUG 98

**ASSOCIATED FAULT INDICATION(S):**  
WtLimFlag



21 AUG 1998



21 JUN 1998

**ASSOCIATED FAULT INDICATION(S):**

BeepFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/ ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, AIRCRAFT HARNESS, OR BEEPER SWITCH LOOSE OR DAMAGED
- ROTOR SPEED BEEPER SWITCH FAILURE
- ECU FAILURE
- AIRCRAFT HARNESS FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
(PG 2)

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

DEPENDENT UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, OR THE ROTOR SPEED BEEPER SWITCH, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -

REPLACE THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

C  
(PG 2)

AT CONNECTOR 1A6P2, MEASURE SWITCH RESISTANCE TO GROUND THROUGH HARNESS

SWITCH POS	SOCKET	LIMITS (Ω)
NO BEEP	38	> 100K
NO BEEP	41	> 100K
BEEP UP	38	<1
BEEP UP	41	> 100K
BEEP DOWN	38	> 100K
BEEP DOWN	41	<1

ARE MEASUREMENTS WITHIN LIMITS?

No

Yes

A  
(PG 2)

AT CONNECTOR 4A2J1, MEASURE SWITCH RESISTANCE ACROSS PINS AT THE SWITCH

SWITCH POS.	PINS	LIMITS (Ω)
NO BEEP	4 & 5	> 100K
NO BEEP	6 & 5	> 100K
BEEP UP	4 & 5	<1
BEEP UP	6 & 5	> 100K
BEEP DOWN	4 & 5	> 100K
BEEP DOWN	6 & 5	<1

ARE MEASUREMENTS WITHIN LIMITS?

No

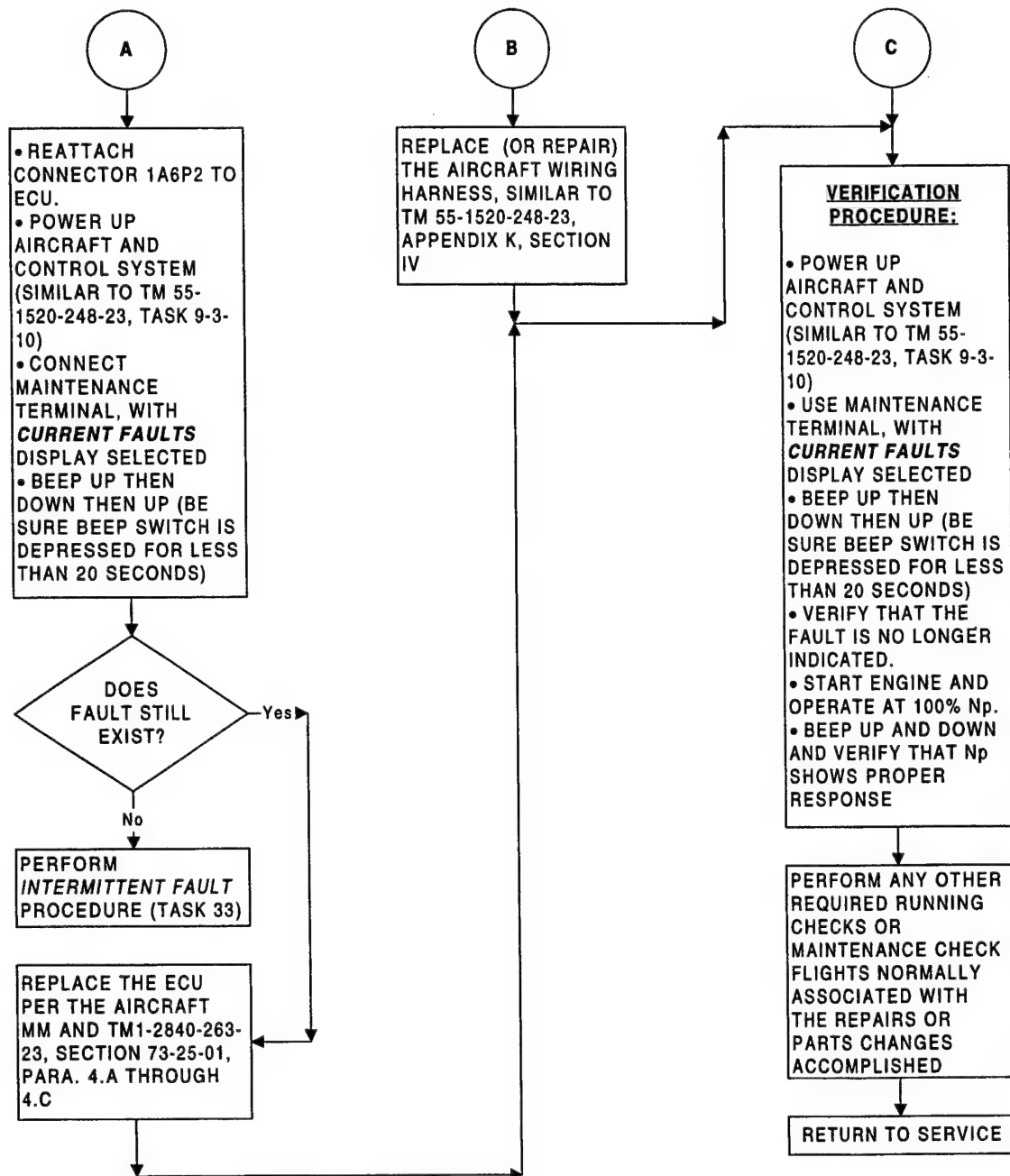
Yes

B  
(PG 2)

REPLACE THE ROTOR SPEED BEEPER SWITCH ASSEMBLY (4A2) SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

C  
(PG 2)

21 AUG 1998



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**ASSOCIATED FAULT INDICATION(S):**

BpStuckFit

**DESCRIPTION:**

THE ECU INDICATES A PROBLEM WITH THE ECU/ ROTOR SPEED TRIM "BEEPER" SWITCH CIRCUIT

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, AIRCRAFT HARNESS, OR BEEPER SWITCH LOOSE OR DAMAGED
- ROTOR SPEED BEEPER SWITCH FAILURE
- ECU FAILURE
- AIRCRAFT HARNESS FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
(PG 2)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

DEPENDENT UPON FINDINGS: REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS, OR THE ROTOR SPEED BEEPER SWITCH, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -

REPLACE THE ECU (PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

C  
(PG 2)

AT CONNECTOR 1A6P2, MEASURE SWITCH RESISTANCE TO GROUND THROUGH HARNESS

SWITCH POS	SOCKET	LIMITS (Ω)
NO BEEP	38	> 100K
NO BEEP	41	> 100K

ARE MEASUREMENTS WITHIN LIMITS?

No

Yes

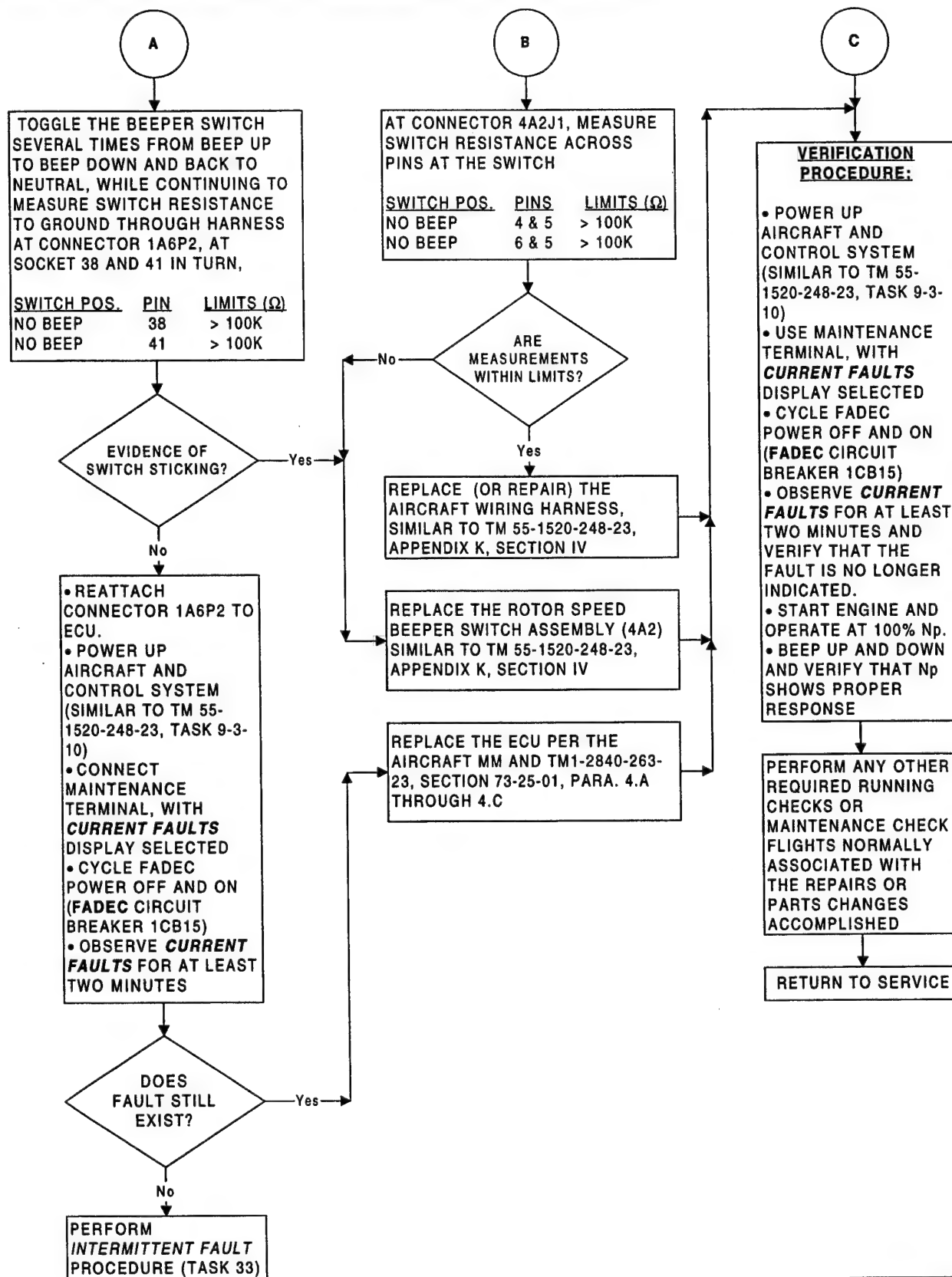
A  
(Pg 2)

B  
(Pg 2)

21 AUG 1998

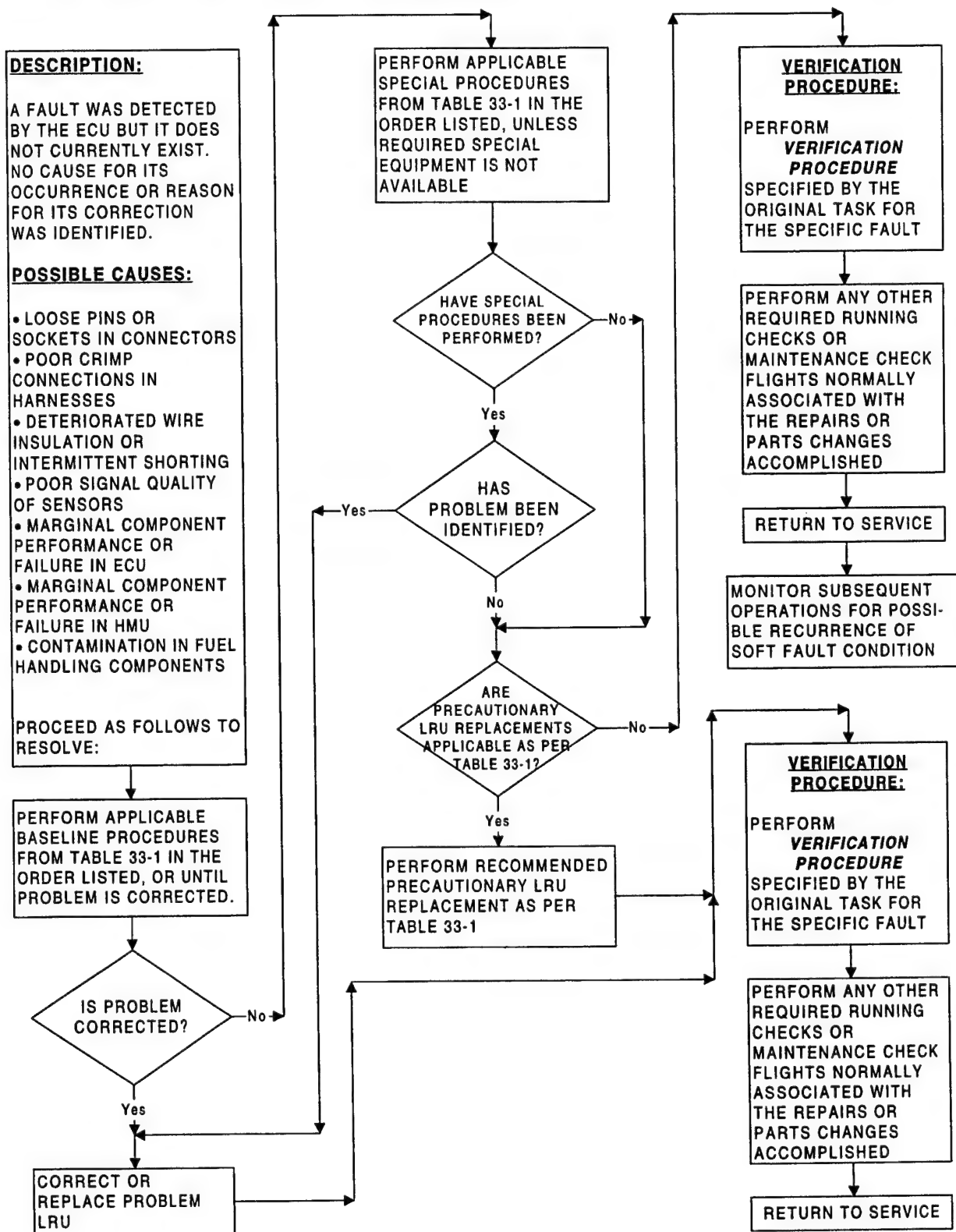
## 32. ROTOR SPEED TRIM "BEEPER" SWITCH STUCK

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TASK	BASELINE PROCEDURE	SPECIAL PROCEDURE	PRECAUTIONARY LRU REPLACEMENT*
1	1	2	1, 2, 3, 7
2	1	2	
3	1		1, 2, 3, 7
4	1	2	
5	1	2, 3	2, 3, 7, 1
6	4A, 1	2, 3	2, 3, 7, 1
7	4C, 1	2, 3	4, 1, 3, 7
8	1	2, 4C	5, 3, 7, 1
9	1	2, 4C	6, 3, 7, 1
10	1	2, 4C	
11	1	2, 4E	
12	1	2, 4C	
13	4B, 1	2	
14	1	2, 4D	
17	1	2, 4F	
18	1	2	
19	1	2	9, 1, 8
20	1	2	
21	1	2, 4D	2, 3, 7
23	1	2	
24	1	2, 4C	
31	1	2	
32	1	2	

**\*LRU IDENTIFICATION**

1. Electronic Control Unit (ECU)
2. Hydromechanical Unit (HMU)
3. Engine Harness
4. T1 (CIT) Sensor
5. Np Sensor
6. Ng Sensor
7. Engine Interface Harness (Connects to ECU 1A6J1 connector)
8. Aircraft Harness (connects to ECU 1A6J2 connector)
9. FADEC Auto/Manual Switch

TABLE 33-1

**BASELINE AND SPECIAL FAULT PROCEDURES:****1. COMPREHENSIVE HARNESS AND CONNECTOR CHECK**

Repeat all circuit resistance and insulation resistance checks listed in the original task for the fault being investigated, including those checks omitted in following the logical sequence of task steps. Insulation resistance should be checked between the circuit and ground, and between the circuit and other pins. Flex the harnesses if possible while making resistance measurements to detect intermittent shorts/opens. Concurrently, check for connector looseness, damaged pins or recessed sockets as possible cause of fault at every connection listed in the original task

**2. CONNECTOR SOCKET RETENTION CHECK**

Perform socket retention check specified by Bell AMM procedure at all applicable interface harness or airframe harness connection points identified in the original task for the fault being investigated.

**NOTE TO REVIEWER: BHT CONNECTOR SOCKET RETENTION CHECK PROCEDURE MUST BE TRANSCRIBED FROM 407 MAINTENANCE MANUAL AND INSERTED HERE.**

09 SEP 1998

**BASELINE AND SPECIAL FAULT PROCEDURES (Cont.)**

THIS  
SECTION  
MUST AGREE  
WITH AS YET  
UNWRITTEN  
SECTION OF  
73-25-XX

- WARNING:** FOLLOW APPROPRIATE SAFETY PRACTICES TO AVOID PERSONAL INJURY/SHOCK FROM THE HIGH VOLTAGE TEST.
- CAUTION:** ALL CONNECTIONS OF THE PARTICULAR HARNESS MUST BE DISCONNECTED PRIOR TO PERFORMING THE 100-VOLT INSULATION RESISTANCE CHECK TO AVOID POTENTIAL DAMAGE TO COMPONENTS.

3. **XXX-VOLT INSULATION RESISTANCE CHECK**

~~Perform a 100-volt insulation resistance check for the engine harness, interface harness, or airframe harness at pins/sockets applicable per the original task for the fault being investigated. Consult applicable engine manufacturer or airframe manufacturer 100-volt insulation resistance test procedures for the particular harness being tested.~~

4. **MAINTENANCE TERMINAL SIGNAL MONITORING CHECKS**

- A. With engine shut down, move throttle hard against first the minimum and then the maximum stop. Monitor signals listed in Table 33-2 for the task associated with the fault code, against the fault range limits listed in Table 33-2. Replace HMU if PLA signal exceeds the normal range of 0° to 100° by more than 2°, or if signal quality indicates probability of fault limit exceedence.
- B. Move collective pitch lever hard against the minimum stop. Monitor signals listed in Table 33-2 for the task associated with the fault code, against the fault range limits listed in Table 33-2. Readjust or replace collective pitch potentiometer if signal is not 0±5% when at the minimum stop.
- C. Run engine at ground idle and monitor signals listed in Table 33-2 for the task associated with the fault code. Check signal quality considering whether signal could be exceeding rate or range fault limits listed in Table 33-2, or if value of signal is unreasonable for operating condition. Flex harnesses carrying signal (being careful to avoid damaging harness and using caution to avoid personal contact with rotating or hot components), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. If poor signal quality is suspected, replace LRU which is the source of the signal and recheck signal quality. If intermittent is evident by flexing harness, replace suspect harness.
- D. Same as C, except run engine at 100% Np.
- E. Run engine at 85% Np, flat pitch rotor, with airframe electrical power to ECU turned **OFF** (breaker 1CB15 pulled).

**CAUTION:** REVERSION TO MANUAL MODE POSSIBLE DURING THIS PROCEDURE

Monitor signals listed in Table 33-2 for the task associated with the fault code. Flex harnesses carrying signal (being careful to avoid damaging harness and using caution to avoid personal contact with rotating or hot components), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. Replace PMA if signal is within 0.5 volts of fault limits, or if ECU loses power. If intermittent is evident by flexing harness, replace suspect harness.

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**BASELINE AND SPECIAL FAULT PROCEDURES (Cont.)****4. MAINTENANCE TERMINAL SIGNAL MONITORING CHECKS (Cont.)**

- F. With engine shut down and power being supplied by battery, monitor signals listed in Table 33-2 for the task associated with the fault code, against limits of Table 33-2. Apply electrical loads representative of conditions in flight and verify limits of Table 33-2 are not exceeded. If conditions are exceeded, troubleshoot aircraft battery or electrical system. Flex harnesses carrying signal (being careful to avoid damaging harness), if possible while monitoring signal, to determine if intermittent signal change is evident with harness flexing. If intermittent is evident by flexing harness, replace suspect harness.

TASK	SIGNAL	RANGE LIMIT	RATE-OF-CHANGE LIMIT	DIFFERENCE LIMIT
5	WfmvRaw	-121.7 pph to 568.0 pph	962.5 pph/sec	
6	PLA1Raw	-5° to 110°		IPLA1Raw -PLA2Rawl < 5°
	PLA2Raw	-5° to 110°		
	PLARfRaw	4.95 to 5.05 volts		
7	T1ARaw	-75°F to 225°F	200°F/sec	IT1ARaw - T1BRawl < 30°F
	T1BRaw	-75°F to 225°F	200°F/sec	
8	Np1Raw	20% to 160% (Ng > 71%)	400%/sec	INp1Raw - Np2Rawl < 5%
	Np2Raw	20% to 160% (Ng > 71%)	400%/sec	
9	Ng1Raw	8% to 130% (Engine Running)	375%/sec	INg1Raw - Ng2Rawl < 5%
	Ng2Raw	8% to 130% (Engine Running)	375%/sec	
10	MGTRaw	-77°F to 2400°F	2000°F	
11	AI28Raw	8.5 to 60 volts		
	AltRipRaw (Ripple)	< 3.0 volts		
12	QRaw (100% = 524 ft-lbs)	-10% to 200% (Normal Limits) [5% to 200% (if Ng > 85%, not Decelerating)]	1500%/sec	
13	CPRaw (100% = Full Up)	-14.4% to 110%		
14	NrRaw	40% to 150% (Ng > 71%)	400%/sec	
15	P1Raw	5.0 psia to 16.0 psia	40 psi/sec	
17	AF28Raw	8.5 to 35.0 volts		
21	WfStp	-121.7 pph to 568.0 pph		IWfStp - WfmvRawl < 42 pph
	WfmvRaw	-121.7 pph to 568.0 pph		
22	WfmvRaw	< 13 to 16 pph Prior to Start		
24	NpA1Raw			INpA1Raw - Npl < 2.5%
	NpA2Raw			INpA2Raw - Npl < 2.5%
	NpA3Raw			INpA3Raw - Npl < 2.5%
	NpA4Raw			INpA4Raw - Npl < 2.5%
	Np			

**TABLE 33-2**

09 SEP 1998

**ASSOCIATED FAULT INDICATION(S):**

AD12BitFit, AD8BitFit, AMSolFit,  
 AMSwFit, ECUOTFit, GainFit, HLRfFit,  
 Ng12Fit, Np12Fit, OffsFit, P1HdFit,  
 PLAHdFit, PROMFit, PW10Fit, RAMFit,  
 SmFit, StepCntFit, T1ABFit, V15Fit,  
 V5Fit, WDTTimeOut, WfHdFit, WfStFit

**DESCRIPTION:**

A **FADEC FAIL** WARNING IS  
 DISPLAYED ON MFD BUT  
 NO CURRENT HARD  
 FAULTS ARE INDICATED

**POSSIBLE CAUSES:**

- ECU NOT POWERED, OR FAILURE OF AIRCRAFT POWER SUPPLY TO ECU
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO  
 RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY

ANY OF  
 LISTED **ASSOCIATED**  
**FAULTS** ACTIVE?

Yes

No

PERFORM MAINTENANCE  
 TASKS AND VERIFICATION  
 PROCEDURES  
 ASSOCIATED WITH THE  
 DISPLAYED FAULT CODES

DEPOWER AIRCRAFT  
 (SIMILAR TO TM 55-  
 1520-248-23, TASK 9-3-  
 11)

**BEFORE**  
 DISCONNECTING ANY  
 CONNECTOR, FIRST  
 CHECK FOR  
 LOOSENESS AS  
 POSSIBLE CAUSE OF  
 FAULT.

IS CONNECTOR  
 TIGHT?

No

Yes

TIGHTEN THE  
 CONNECTOR,  
 ENSURING PROPER  
 KEYING BETWEEN THE  
 MATING PLUG AND  
 RECEPTACLE

**AFTER**  
 DISCONNECTING ANY  
 CONNECTOR,  
 IMMEDIATELY  
 EXAMINE PINS AND  
 SOCKETS

ARE PINS OR  
 SOCKETS BENT,  
 RECESSED OR  
 MISSING?

No

Yes

**DEPENDING UPON FINDINGS:**  
 REPLACE (OR REPAIR) THE  
 AIRCRAFT WIRING HARNESS  
 CONNECTED TO THE ECU AND  
 TO THE DISCRETE  
 INDICATORS KEYBOARD UNIT  
 (3431A3), SIMILAR TO TM 55-  
 1520-248-23, SECTION 73-25-01,  
 SECTION IV

- OR -

REPLACE THE ECU (PER THE  
 AIRCRAFT MM AND MM TM1-  
 2840-263-23, SECTION 73-25-01,  
 PARA. 4.A THROUGH 4.C)

C  
 (PG 2)

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CHECK FOR PRESENCE OF 28 VDC POWER AT SOCKET 25. MEASURE BETWEEN SOCKET AND GROUND STRAP.  
**LIMIT 28 ± 1 VDC**

IS VOLTAGE  
 WITHIN LIMITS?

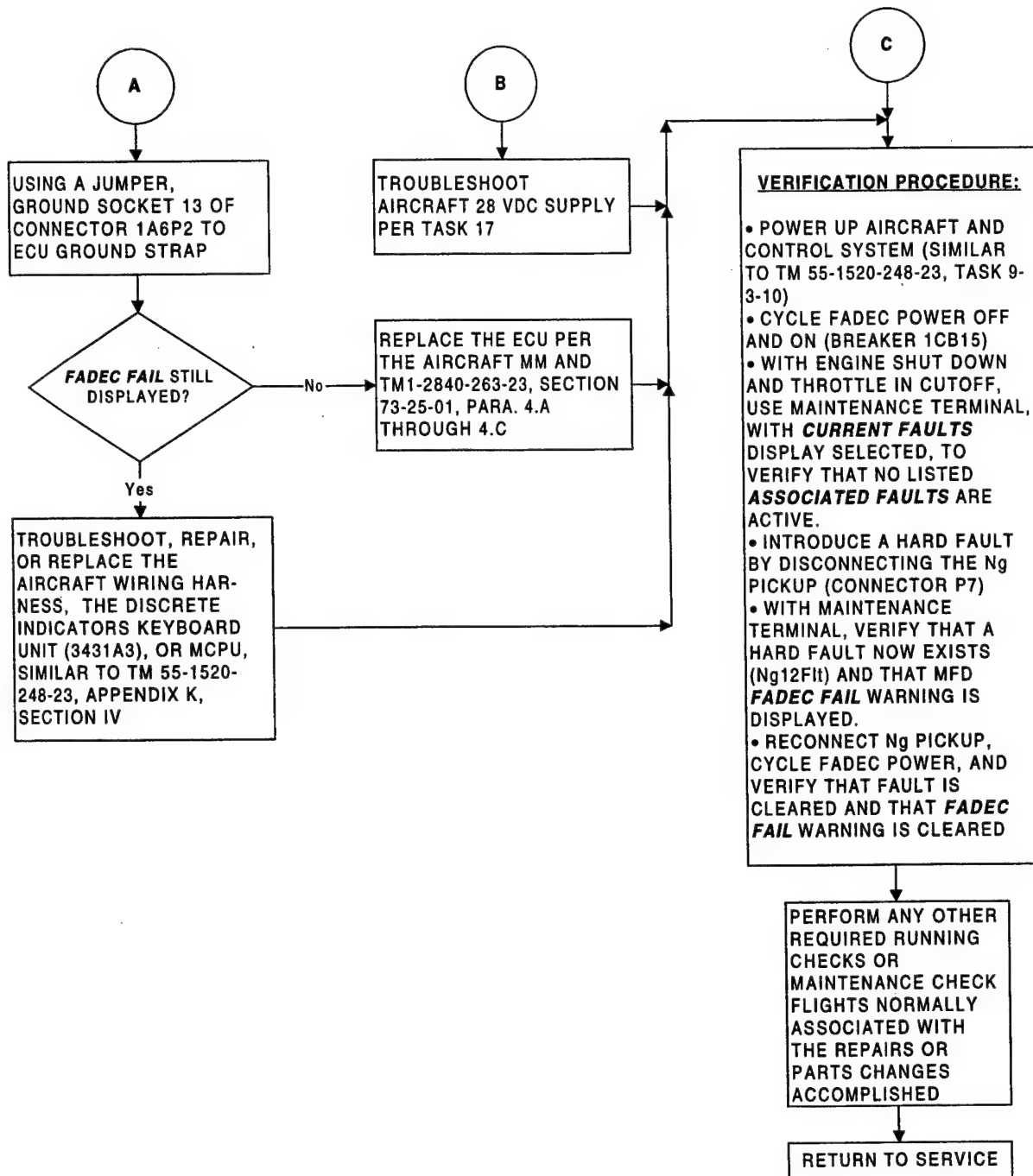
No

Yes

B  
 (PG 2)

A  
 (PG 2)

25 AUG 1998



25 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**

AD12BitFlt, AD8BitFlt, AMSolFlt,  
 AMSwFlt, ECUOTFlt, GainFlt, HLRfFlt,  
 Ng12Flt, Np12Flt, OffsFlt, P1HdFlt,  
 PLAHDFlt, PROMFlt, PW10Flt, RAMFlt,  
 SmFlt, StepCntFlt, T1ABFlt, V15Flt,  
 V5Flt, WDTTimeOut, WfHdFlt, WfStFlt

**DESCRIPTION:**

A **FADEC FAIL** WARNING IS NOT DISPLAYED ON MFD WHEN CURRENT HARD FAULTS EXIST

**POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
- USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY

ANY OF LISTED **ASSOCIATED FAULTS** ACTIVE?

No

Yes

MFD IS CORRECTLY REPORTING CURRENT STATUS

C  
(PG 2)

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

No

Yes

**DEPENDENT UPON FINDINGS:**  
 REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -

REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA 4 A THROUGH 4 C)

C  
(PG 2)

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- DISCONNECT CONNECTOR 1A6P2

IS **FADEC FAIL** DISPLAYED?

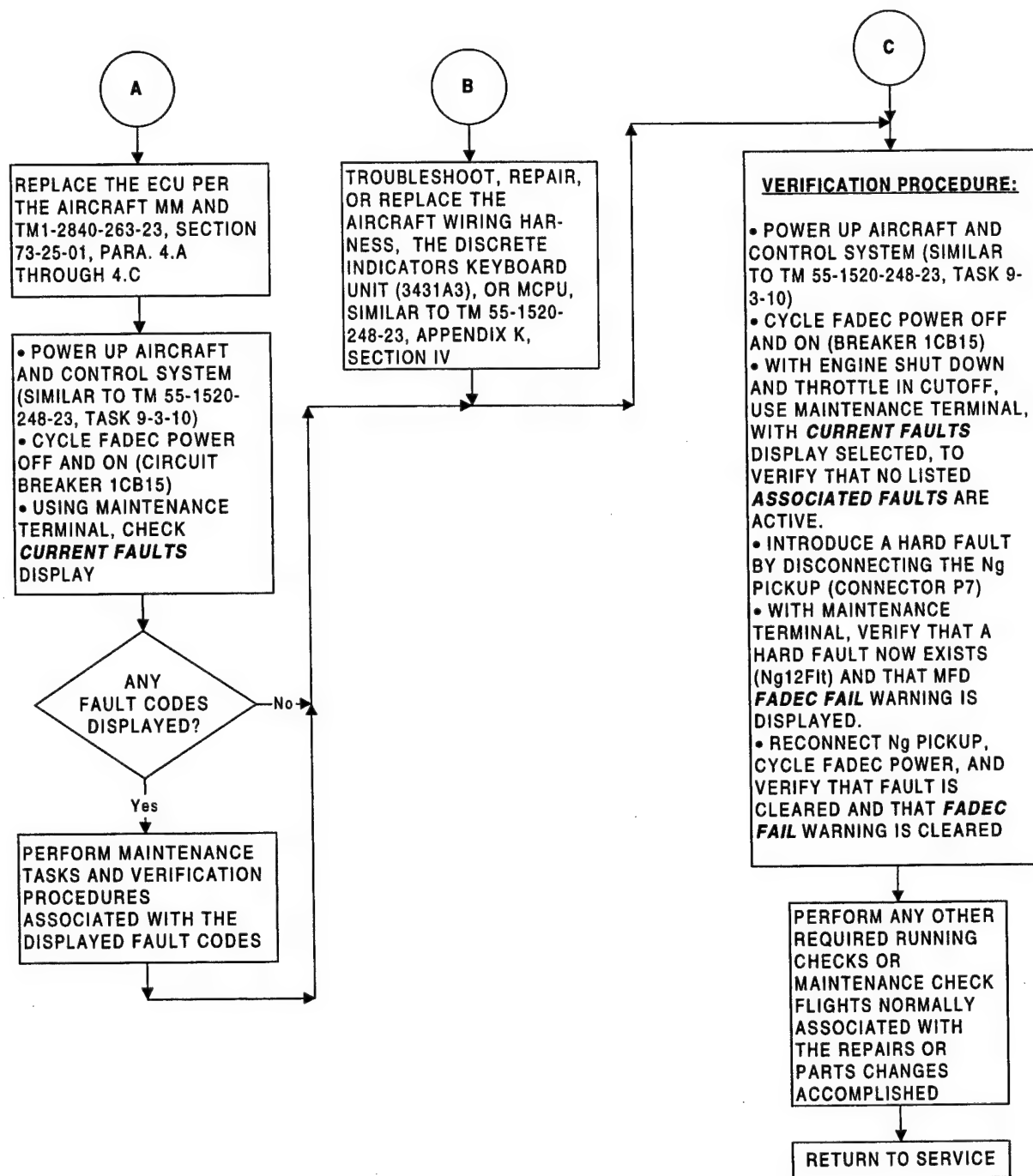
Yes

No

A  
(PG 2)

B  
(PG 2)

24 AUG 1998



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**DESCRIPTION:**

A **FADEC MANUAL** WARNING IS DISPLAYED ON MFD BUT CONTROL IS OPERATING IN THE **AUTO** MODE

**POSSIBLE CAUSES:**

- UNCOMMANDED SWITCHOVER TO **MANUAL** DUE TO FAULT, OR MODE SWITCH INDICATION INCORRECT
- ECU NOT POWERED, OR FAILURE OF AIRCRAFT POWER SUPPLY TO ECU
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)

IS **FADEC MANUAL** WARNING DISPLAYED?

No

Yes

SYSTEM OPERATION IS SATISFACTORY (**FADEC MANUAL** WARNING IS NORMAL WHEN **FADEC** POWER IS OFF)

C  
(PG 3)

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

PERFORM TASK 3 OR 19, AS APPROPRIATE

C  
(PG 3)

DO EITHER OF ABOVE FAULT CODES EXIST?

Yes

No

USING MAINTENANCE TERMINAL, CHECK FOR EXISTENCE OF **AMSoIFit** OR **AMSwFit** IN **CURRENT** OR **LAST ENGINE RUN** MEMORY

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
(PG 3)

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

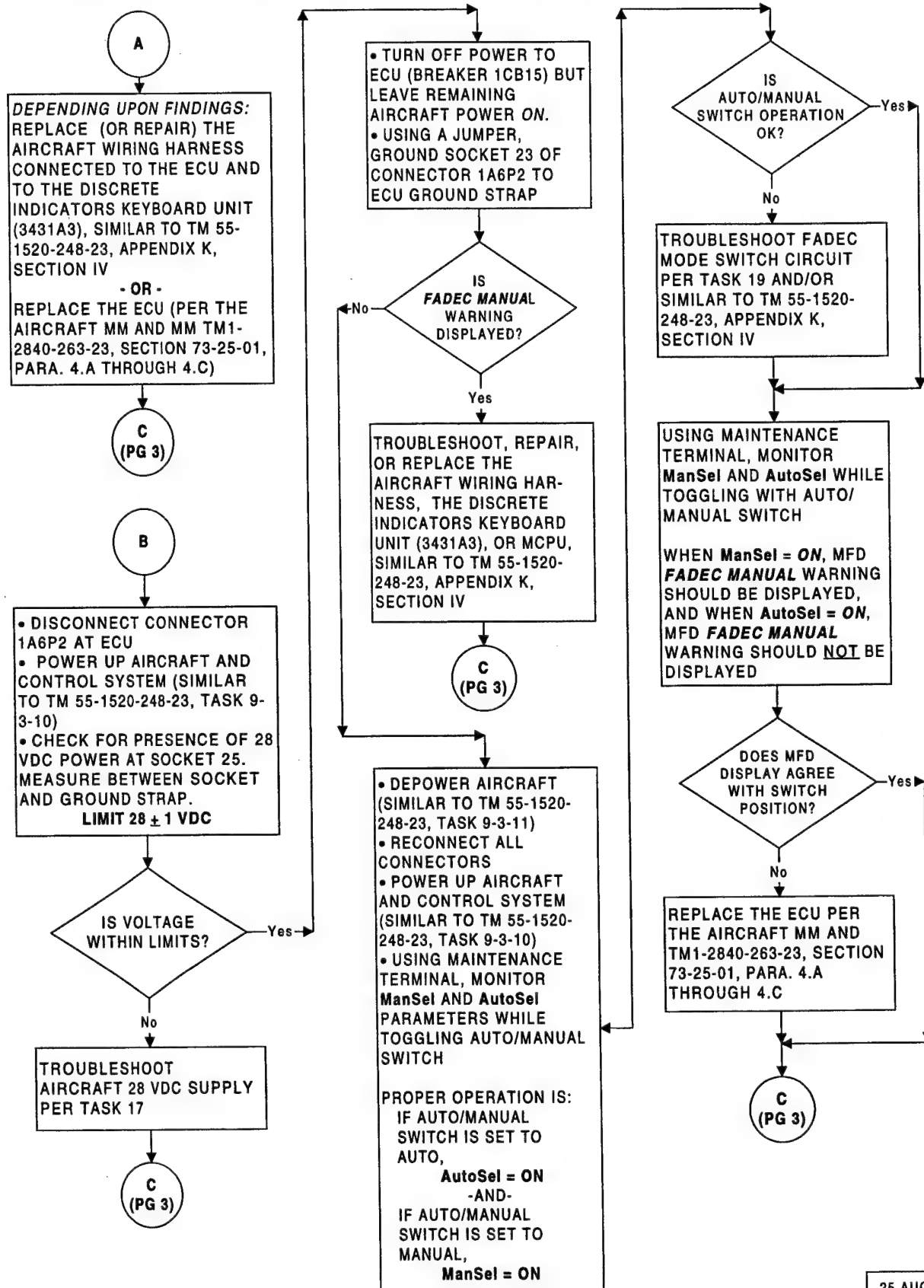
Yes

No

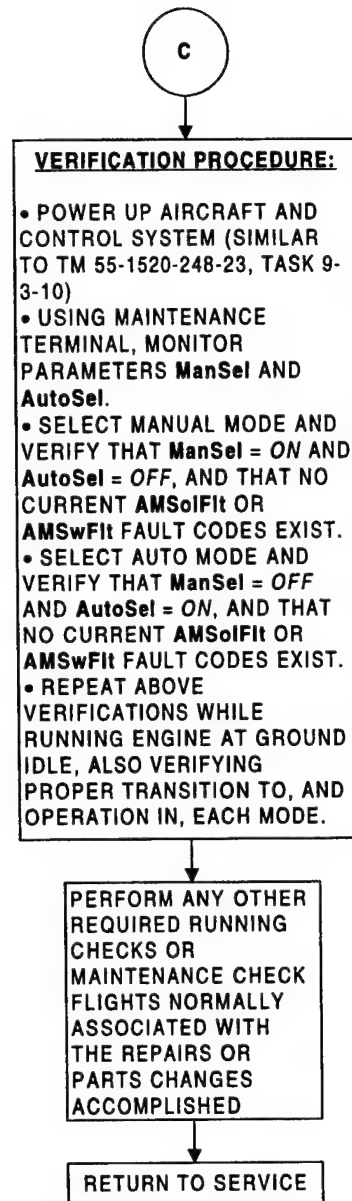
A  
(PG 2)

B  
(PG 2)

25 AUG 1998



25 AUG 1998



25 AUG 1998

# **37. FADEC MANUAL WARNING (MFD) INCORRECTLY "OFF"**

## **DESCRIPTION:**

A FADEC MANUAL WARNING IS NOT DISPLAYED ON MFD WHEN CONTROL IS OPERATING IN THE MANUAL MODE

## **POSSIBLE CAUSES:**

- FADEC MODE SWITCH FAILURE
- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10) USING MAINTENANCE TERMINAL, CHECK FOR EXISTENCE OF AMSoIfit OR AMSwFit FAULT CODES IN CURRENT MEMORY

DO EITHER OF ABOVE FAULT CODES EXIST?

Yes

PERFORM TASK 3 OR 19, AS APPROPRIATE

B (PG 2)

No

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

B (PG 2)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

No

DEPENDENT UPON FINDINGS:  
REPLACE (OR REPAIR) THE AIRCRAFT WIRING HARNESS CONNECTED TO THE ECU AND TO THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

- OR -

REPLACE THE ECU (PER THE AIRCRAFT MM AND MM TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C)

B (PG 2)

• DISCONNECT CONNECTOR 1A6P2 AT ECU

• POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10) BUT LEAVE ECU CIRCUIT BREAKER 1CB15 OPEN (UNPOWERED)

IS FADEC MANUAL WARNING DISPLAYED ON MFD?

Yes

A (PG 2)

No

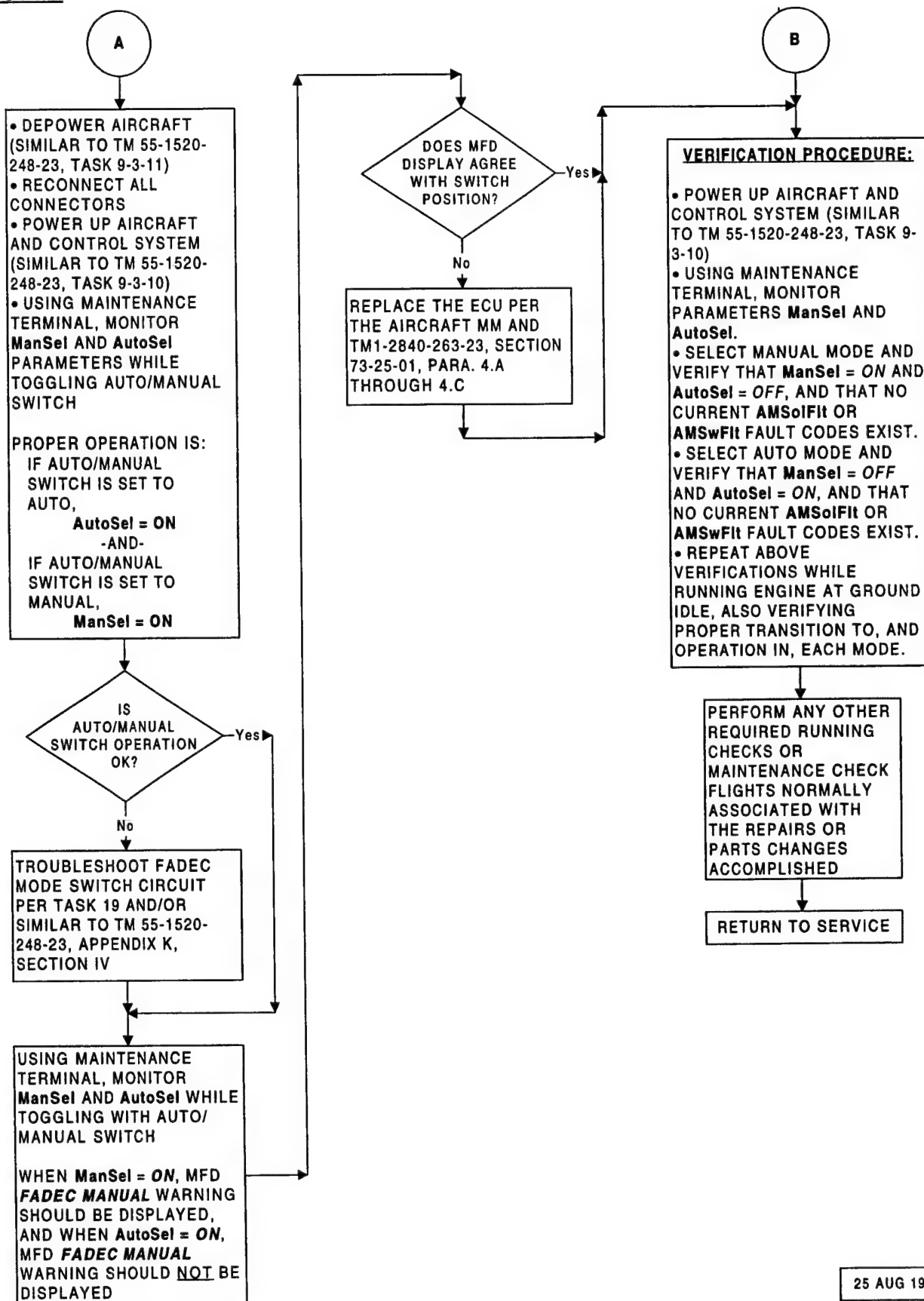
TROUBLESHOOT, REPAIR, OR REPLACE THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR MCPU, SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV

B (PG 2)

25 AUG 1998

# **37. FADEC MANUAL WARNING (MFD) INCORRECTLY "OFF"**

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**ASSOCIATED FAULT INDICATION(S):**

Ng12FIt, Ng1CyFIt, Ng1FIt, Ng1RgFIt,  
Ng1RtFIt, Ng2CyFIt, Ng2FIt, Ng2RgFIt,  
Ng2RtFIt,

**DESCRIPTION:**

THE N<sub>g</sub> COCKPIT GAUGE IS INOPERATIVE OF EXHIBITS ERRATIC BEHAVIOR

**POSSIBLE CAUSES:**

- MATING CONNECTORS ON ECU, HARNESSES, OR N<sub>g</sub> SENSOR LOOSE OR DAMAGED
- N<sub>g</sub> SENSOR FAILURE
- HARNESS FAILURE
- FAILURE IN AIRCRAFT N<sub>g</sub> INDICATION SYSTEM
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10). USING MAINTENANCE TERMINAL, CHECK **CURRENT FAULTS** DISPLAY AFTER CYCLING FADEC POWER OFF AND ON (FADEC CIRCUIT BREAKER 1CB15)

ANY OF LISTED **ASSOCIATED FAULTS** ACTIVE?

Yes

PERFORM MAINTENANCE TASK 9 AND RELATED VERIFICATION PROCEDURE

RESOLVE CONDITION IN ACCORDANCE WITH TM1-2840-263-23, CHAPTER 72-00-00, TABLE 101, AND RELATED SUPPLEMENTARY TROUBLESHOOTING SEQUENCES, AS WELL AS CHAPTER 73-21-00, PARA. 5.

**VERIFICATION PROCEDURE:**

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- CYCLE FADEC POWER OFF AND ON (CIRCUIT BREAKER 1CB15)
- USE MAINTENANCE TERMINAL, WITH **CURRENT FAULTS** DISPLAY SELECTED, TO VERIFY THAT NO FAULTS ARE PRESENT.
- OPERATE ENGINE AT 100% N<sub>p</sub> WITH FLAT PITCH ROTOR, AND VERIFY NO N<sub>g</sub> RELATED FAULTS APPEAR.
- VERIFY PROPER COCKPIT N<sub>g</sub> INDICATION.

PERFORM ANY OTHER REQUIRED RUNNING CHECKS OR MAINTENANCE CHECK FLIGHTS NORMALLY ASSOCIATED WITH THE REPAIRS OR PARTS CHANGES ACCOMPLISHED

RETURN TO SERVICE

25 AUG 1998

**ASSOCIATED FAULT INDICATION(S):**

Np12Flt, Np1CyFlt, Np1Flt, Np1RgFlt,  
Np1RtFlt, Np2CyFlt, Np2Flt, Np2RgFlt,  
Np2RtFlt,

**DESCRIPTION:**

THE  $N_p$  COCKPIT GAUGE IS  
INOPERATIVE OR EXHIBITS  
ERRATIC BEHAVIOR

**POSSIBLE CAUSES:**

- MATING CONNECTORS  
ON ECU, HARNESSES, OR  
Np SENSOR LOOSE OR  
DAMAGED
- Np SENSOR FAILURE
- HARNESS FAILURE
- FAILURE IN AIRCRAFT Np  
INDICATION SYSTEM
- ECU FAILURE

PROCEED AS FOLLOWS TO  
RESOLVE:

POWER UP AIRCRAFT AND  
CONTROL SYSTEM  
(SIMILAR TO TM 55-1520-  
248-23, TASK 9-3-10).  
USING MAINTENANCE  
TERMINAL, CHECK  
**CURRENT FAULTS**  
DISPLAY AFTER CYCLING  
FADEC POWER OFF AND  
ON (FADEC CIRCUIT  
BREAKER 1CB15)

ANY OF  
LISTED **ASSOCIATED**  
**FAULTS** ACTIVE?

Yes

PERFORM MAINTENANCE  
TASK 8 AND RELATED  
VERIFICATION  
PROCEDURE

RESOLVE CONDITION  
IN ACCORDANCE WITH  
TM1-2840-263-23,  
CHAPTER 72-00-00,  
TABLE 101, AND  
RELATED  
SUPPLEMENTARY  
TROUBLESHOOTING  
SEQUENCES, AS WELL  
AS CHAPTER 73-21-00,  
PARA. 4.

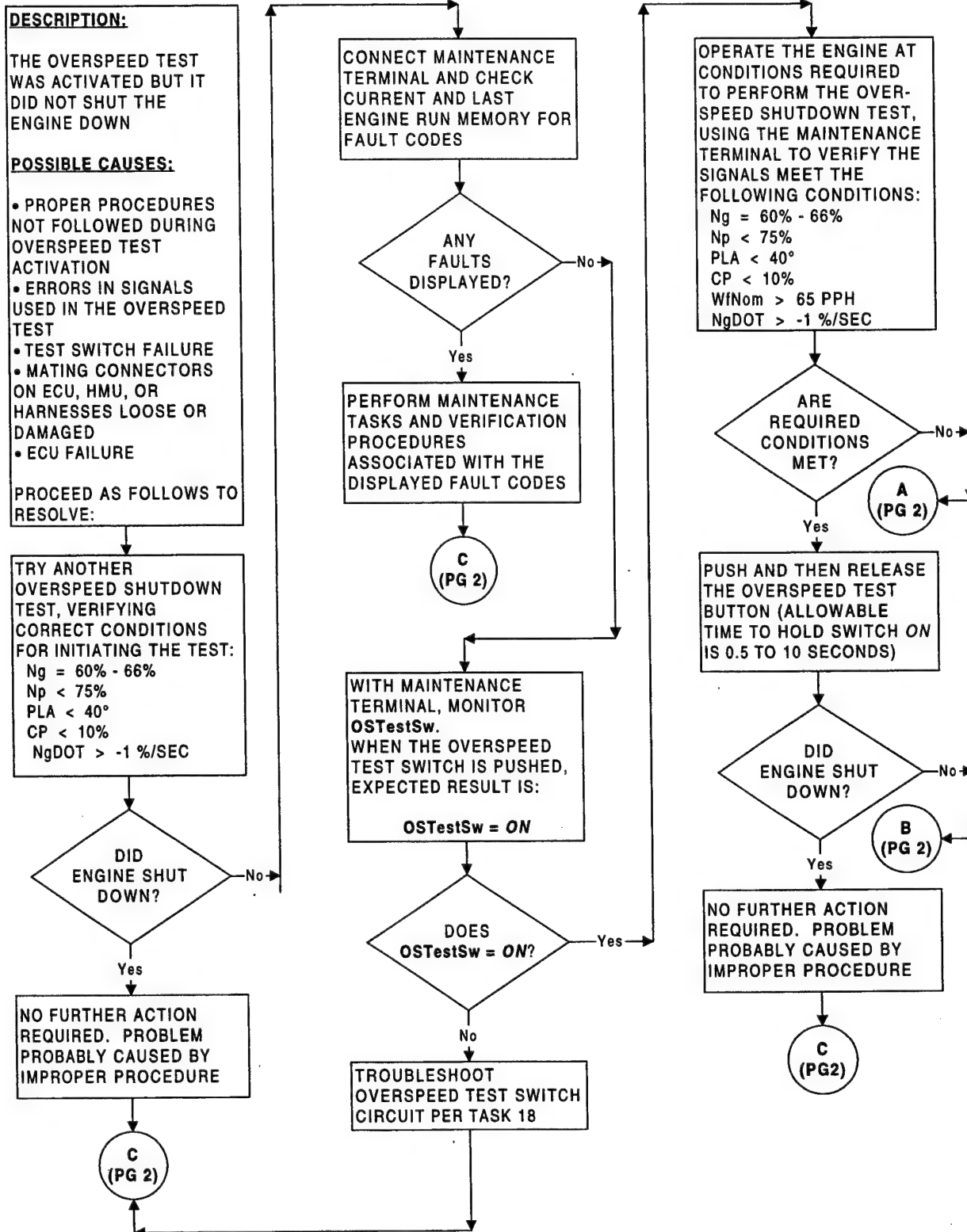
**VERIFICATION  
PROCEDURE:**

- POWER UP  
AIRCRAFT AND  
CONTROL SYSTEM  
(SIMILAR TO TM 55-  
1520-248-23, TASK 9-3-  
10)  
CYCLE FADEC  
POWER OFF AND ON  
(CIRCUIT BREAKER  
1CB15)
- USE MAINTENANCE  
TERMINAL, WITH  
**CURRENT FAULTS**  
DISPLAY SELECTED,  
TO VERIFY THAT NO  
FAULTS ARE PRESENT.
- OPERATE ENGINE AT  
100%  $N_p$  WITH FLAT  
PITCH ROTOR, AND  
VERIFY NO Np  
RELATED FAULTS  
APPEAR.
- VERIFY PROPER  
COCKPIT DUAL  
TACHOMETER Np  
INDICATION.

PERFORM ANY OTHER  
REQUIRED RUNNING  
CHECKS OR  
MAINTENANCE CHECK  
FLIGHTS NORMALLY  
ASSOCIATED WITH  
THE REPAIRS OR  
PARTS CHANGES  
ACCOMPLISHED

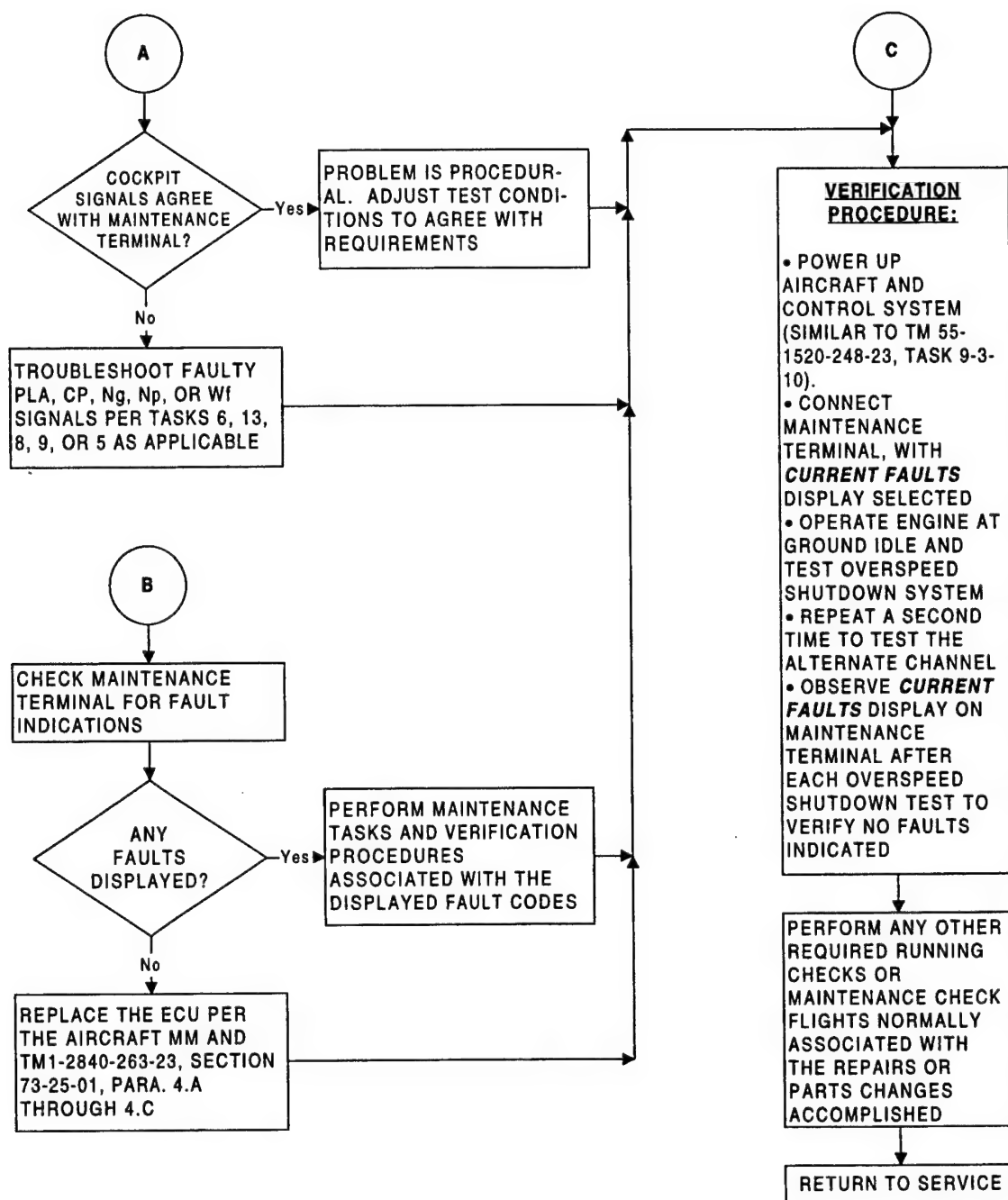
RETURN TO SERVICE

25 AUG 1998

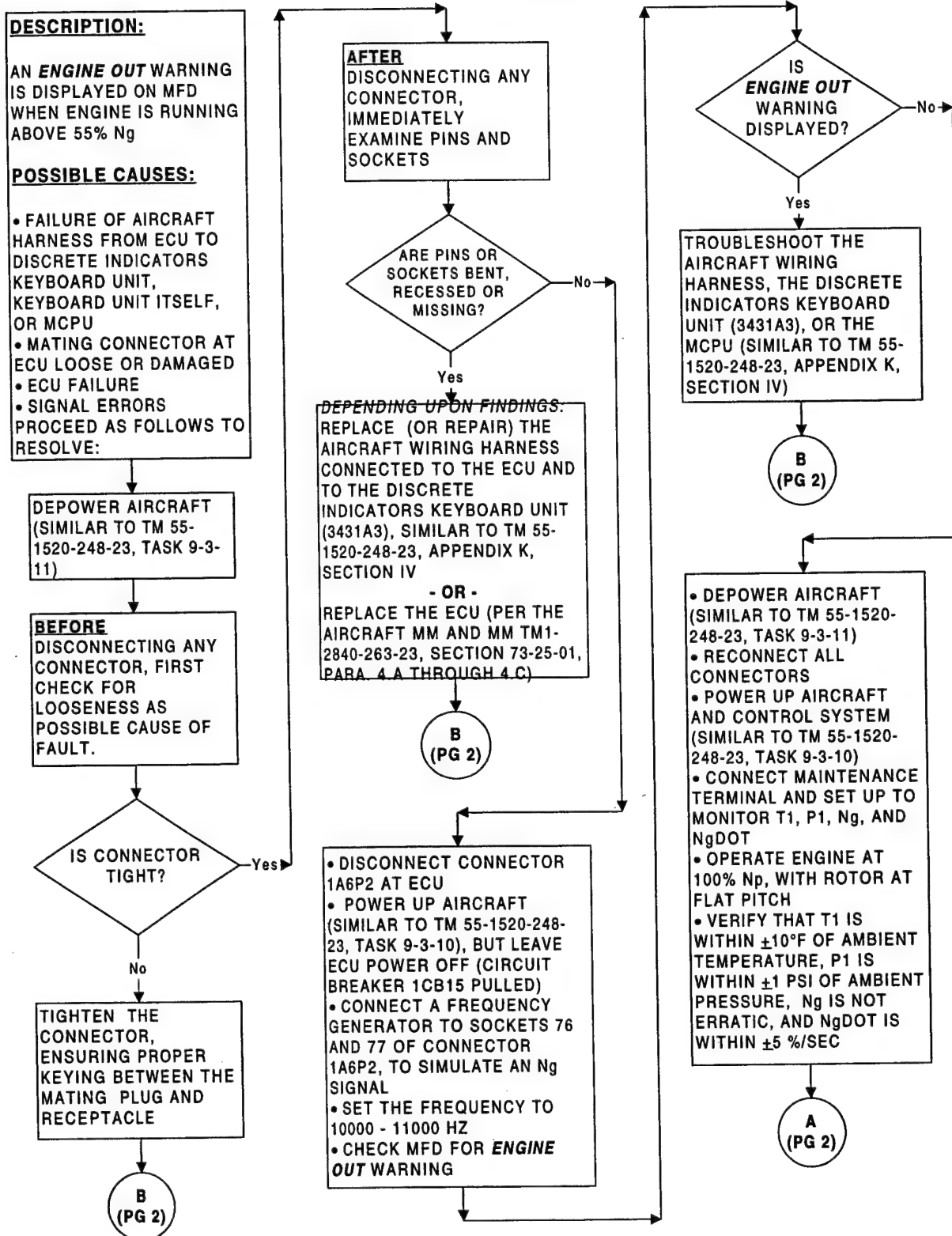


26 AUG 1998

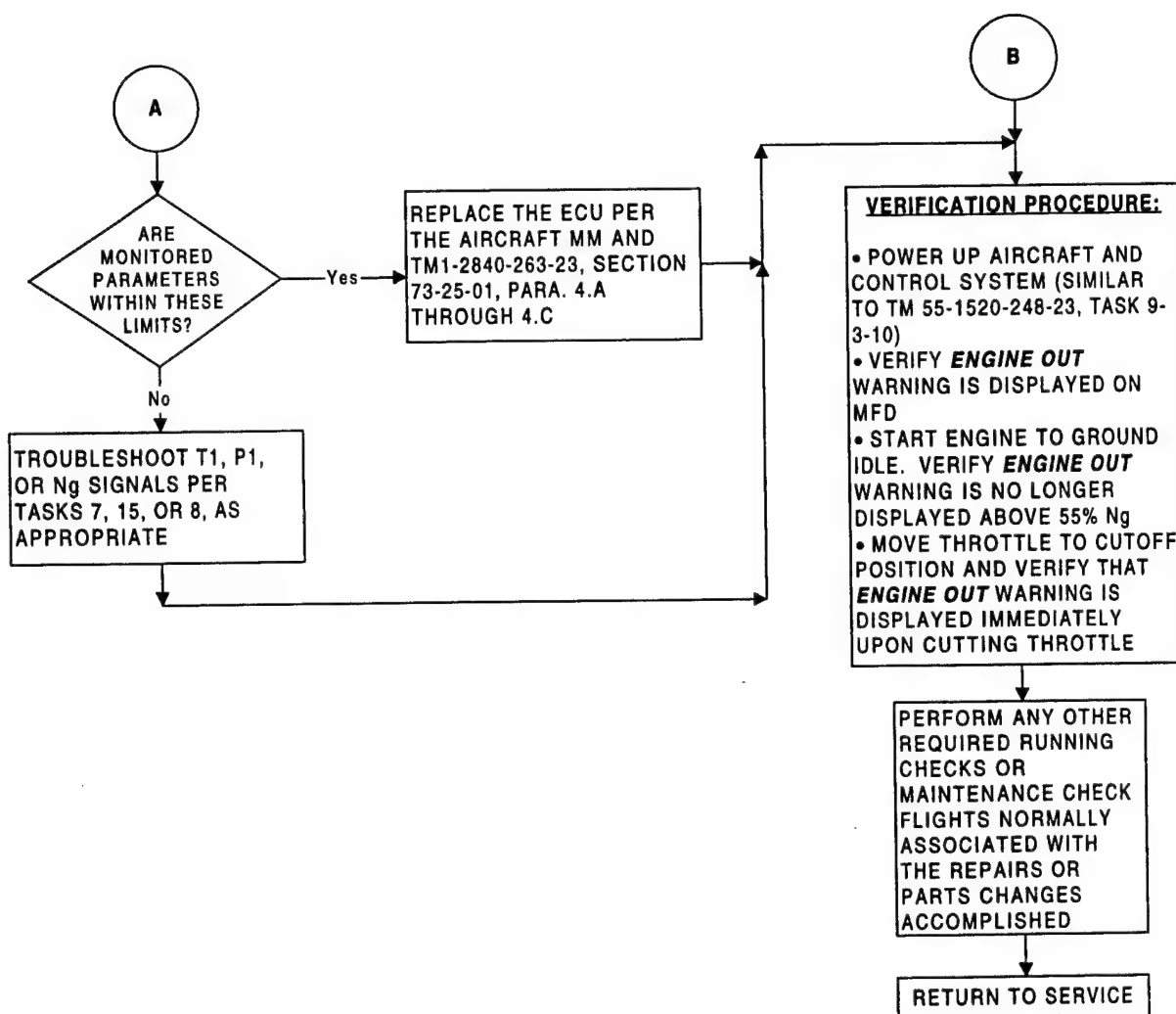




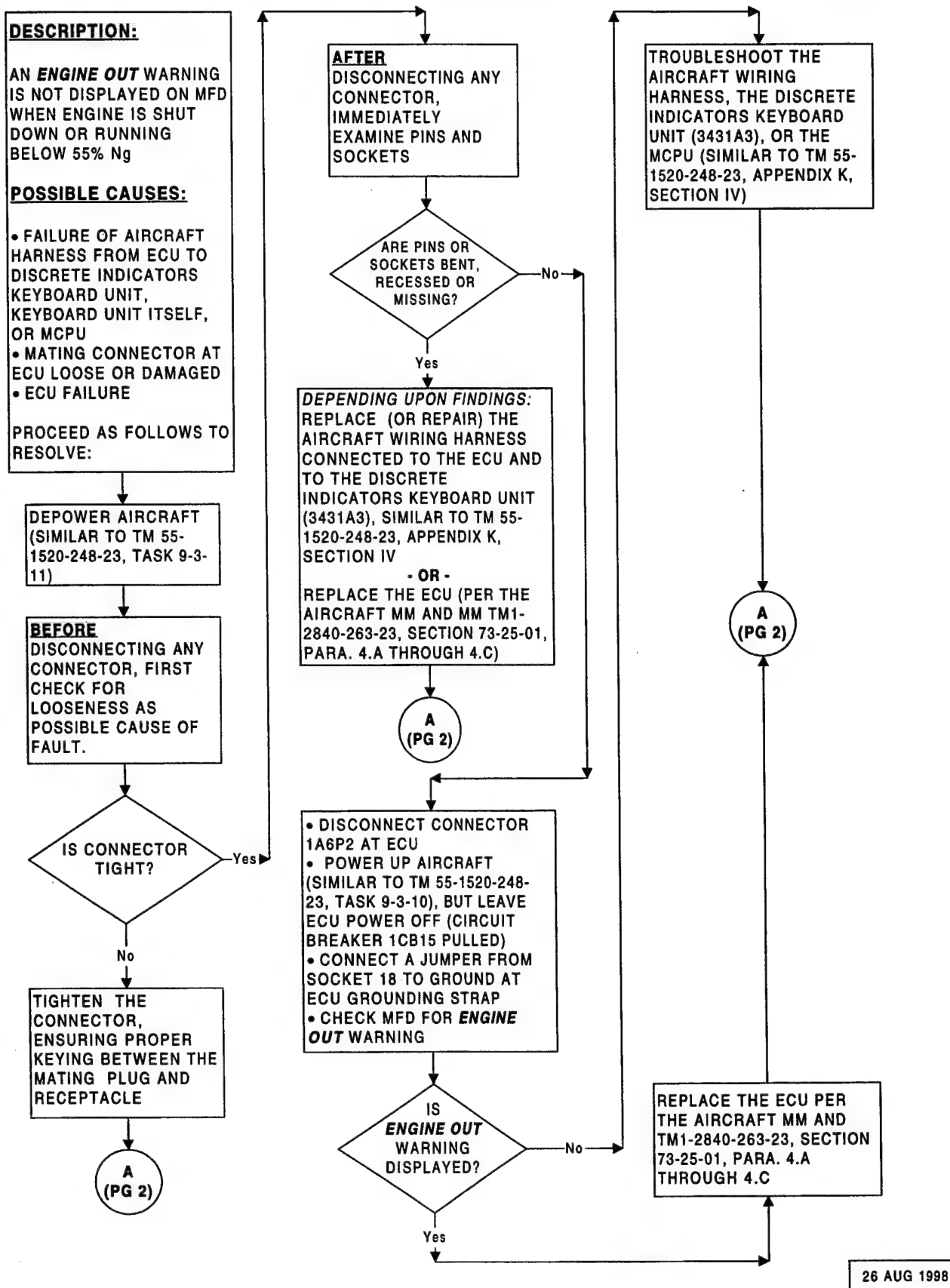
26 AUG 1998

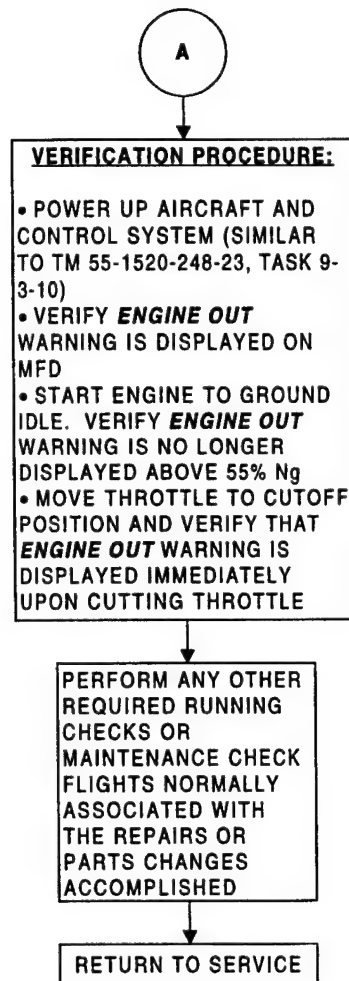


26 AUG 1998

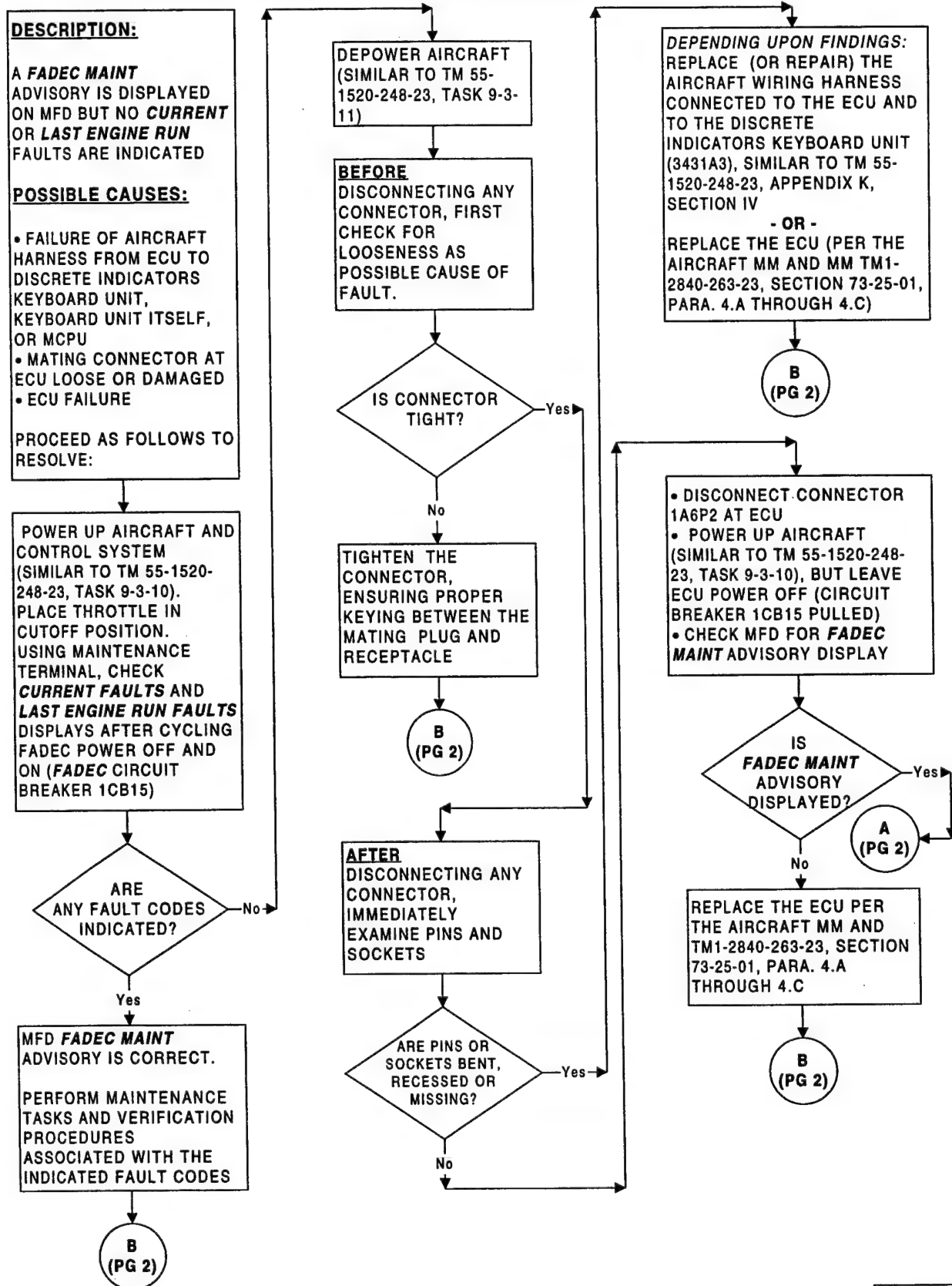


26 AUG 1998

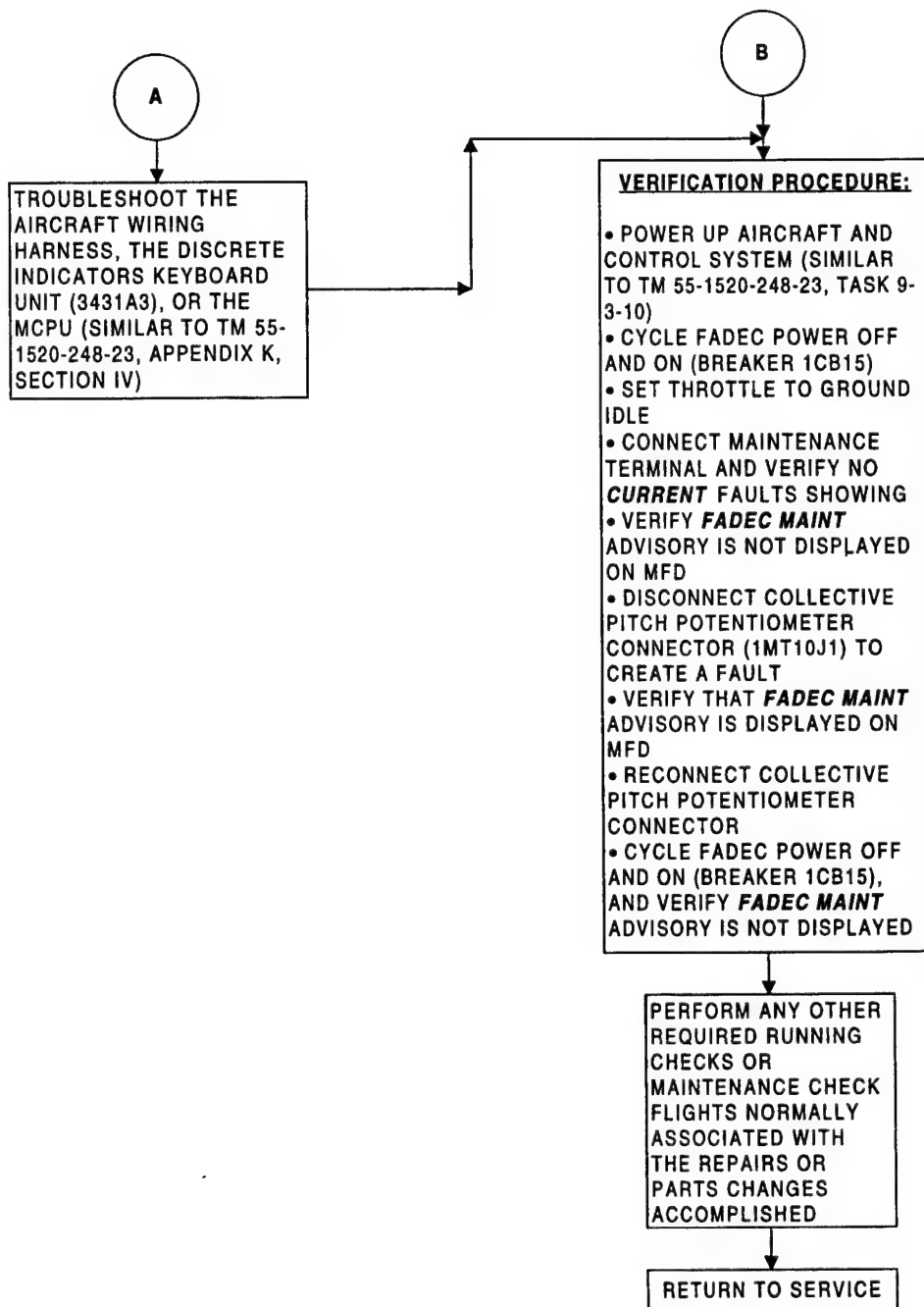




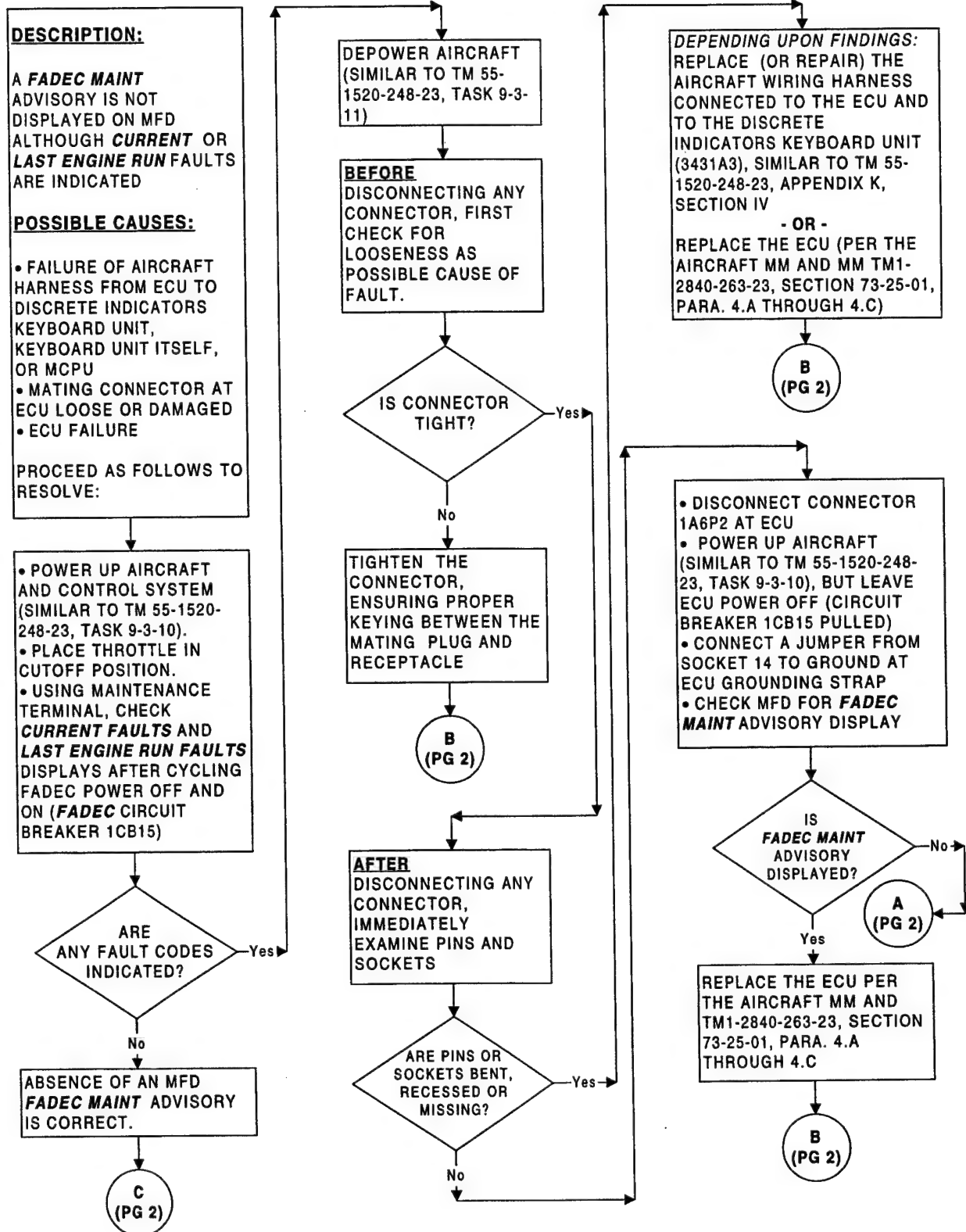
26 AUG 1998



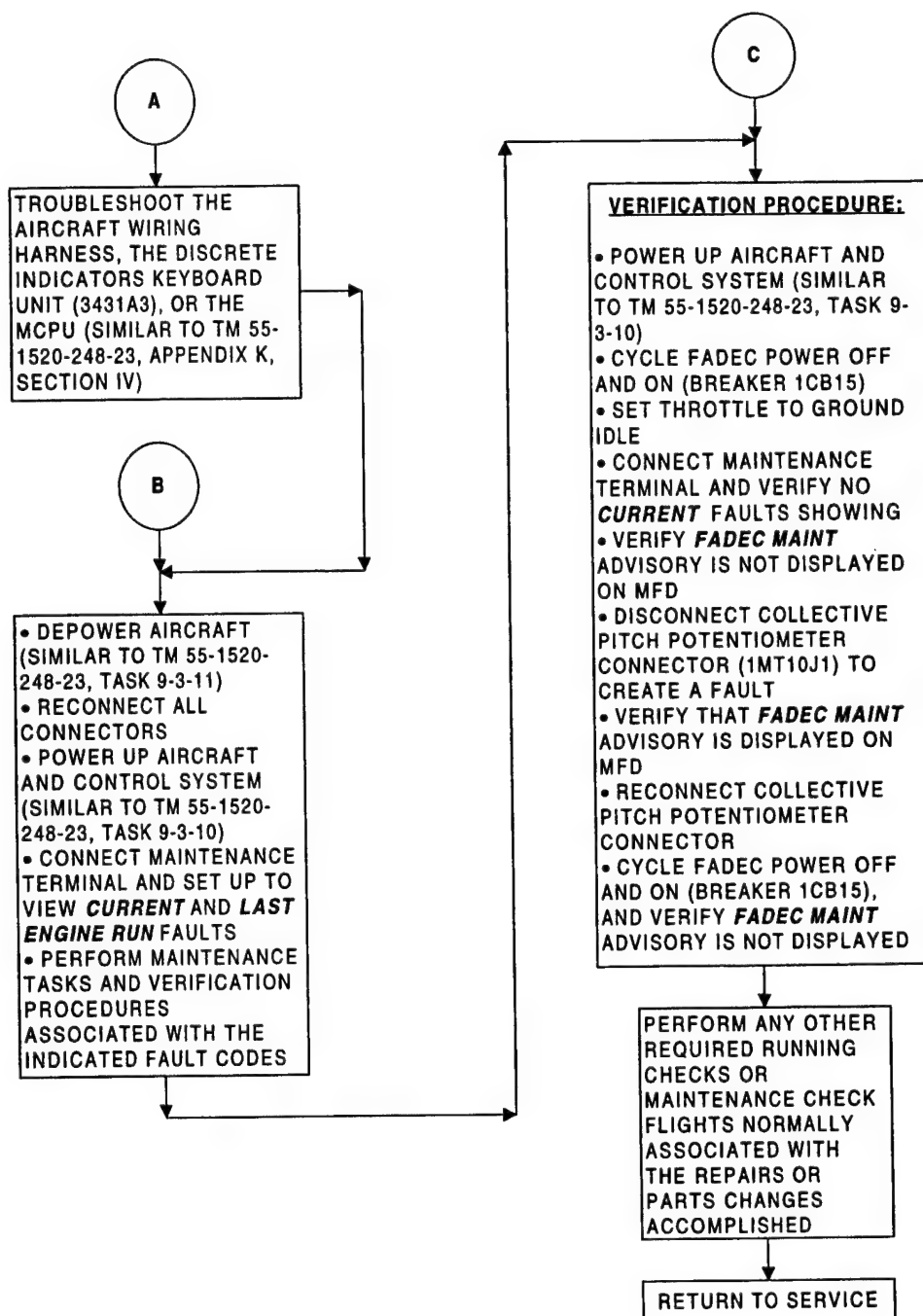
01 SEP 1998



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01 SEP 1998

**ASSOCIATED FAULT INDICATION(S):**

AD12BitFit, AD8BitFit, AMSolFit,  
AMSwFit, ECUOTFit, GainFit, HLRfFit,  
Ng12Fit, Np12Fit, OffsFit, P1HdFit,  
PLAHdFit, PROMFit, PW10Fit, RAMFit,  
SmFit, StepCntFit, T1ABFit, V15Fit,  
V5Fit, WDTTimeOut, WfHdFit, WfStFit

**DESCRIPTION:**

THE CONTROL SYSTEM IS  
OPERATING **FAIL-FIXED**  
BUT THERE IS NO **FADEC**  
**FAIL** WARNING ON MFD

**POSSIBLE CAUSES:**

- 28 VDC SUPPLY TO ECU IS LOW
- HMU FAILURE
- ECU FAILURE

PROCEED AS FOLLOWS TO  
RESOLVE:

THIS CONDITION CAN  
OCCUR DURING  
OPERATION BELOW 85%  
Np WITH ECU POWER  
TURNED OFF (BREAKER  
1CB15 OPEN)

WAS THIS  
THE CONDITION  
WHEN EVENT  
OCCURRED?

Yes

No

WAS  
OPERATION ABOVE  
85% Np WITH ECU  
POWER OFF?

Yes

No

CONNECT MAINTENANCE  
TERMINAL AND CHECK  
**CURRENT** AND **LAST**  
**ENGINE RUN** FAULT  
DISPLAYS FOR **HARD**  
FAULTS (LISTED ABOVE AS  
**ASSOCIATED FAULT**  
**INDICATIONS**)

SYSTEM FUNCTION IS SAT-  
ISFACTORY. EVENT WAS  
CAUSED BY ABNORMAL  
OPERATING CONDITION.

C  
(PG 2)

ANY  
HARD FAULTS  
DISPLAYED?

Yes

No

DID EVENT OCCUR  
BELOW 85% Np WITH  
ECU POWER  
ON?

Yes

No

CHECK BOTH AIRCRAFT 28VDC  
POWER SUPPLY AND PMA  
CIRCUIT (PER TASKS 17 AND  
11, RESPECTIVELY)

WERE  
PROBLEMS  
DETECTED?

Yes

No

REPLACE THE ECU PER THE  
AIRCRAFT MM AND TM1-2840-  
263-23, SECTION 73-25-01,  
PARA. 4.A THROUGH 4.C

C  
(PG 2)

• PERFORM MAINTENANCE  
TASKS AND VERIFICATION  
PROCEDURES ASSOCIAT-  
ED WITH THE INDICATED  
FAULT CODES  
• IF THE HARD FAULTS  
HAVE NOT RESULTED IN A  
**FADEC FAIL** WARNING ON  
THE MFD, TROUBLESHOOT  
PER TASK 35

C  
(PG 2)

CHECK THE AIRCRAFT  
28VDC POWER SUPPLY  
SYSTEM PER TASK 17

IS  
AIRCRAFT 28 VDC  
POWER SUPPLY  
OK?

Yes

No

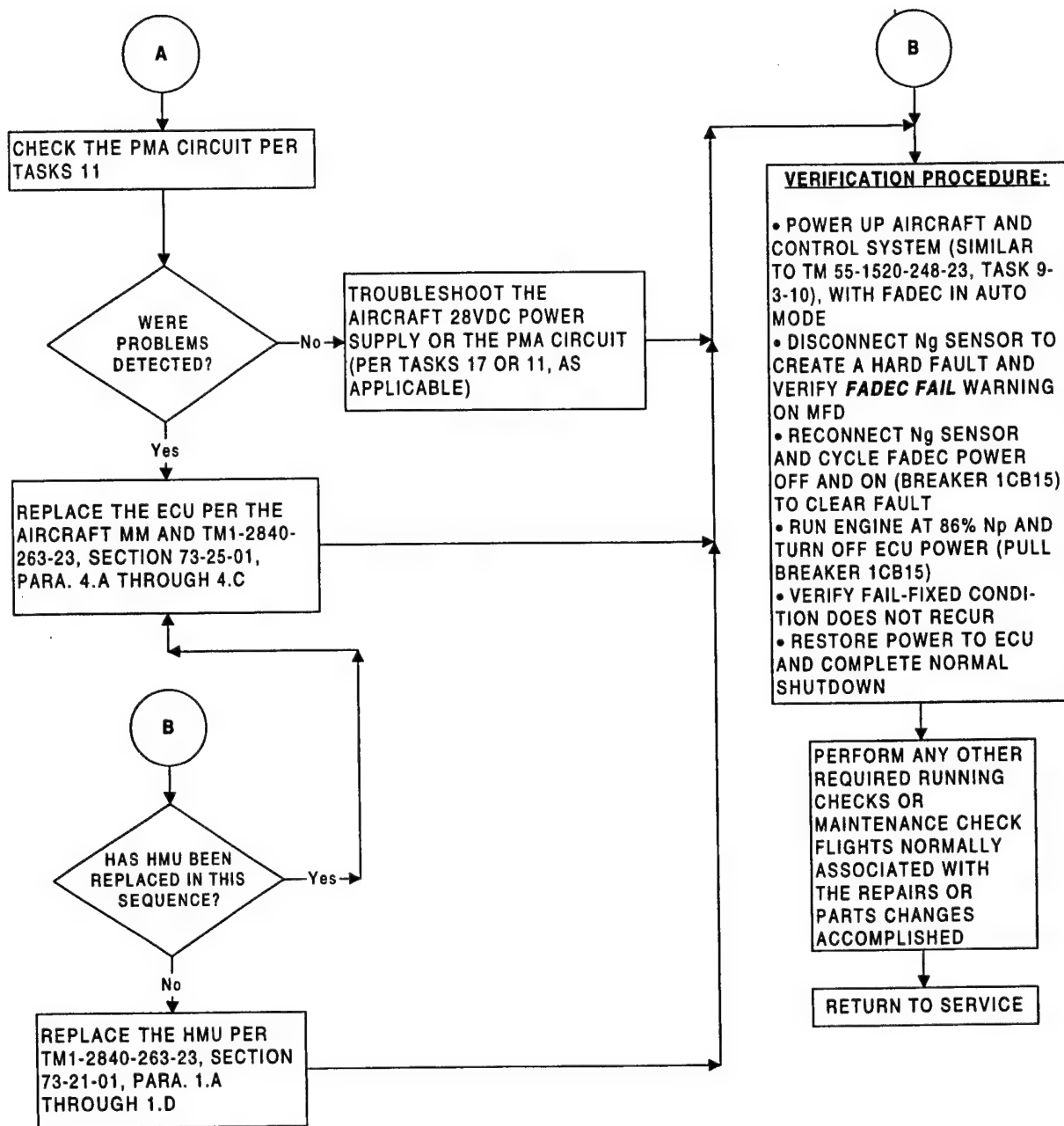
B  
(PG 2)

TROUBLESHOOT THE  
AIRCRAFT 28 VDC POWER  
SUPPLY SYSTEM PER  
TASK 17

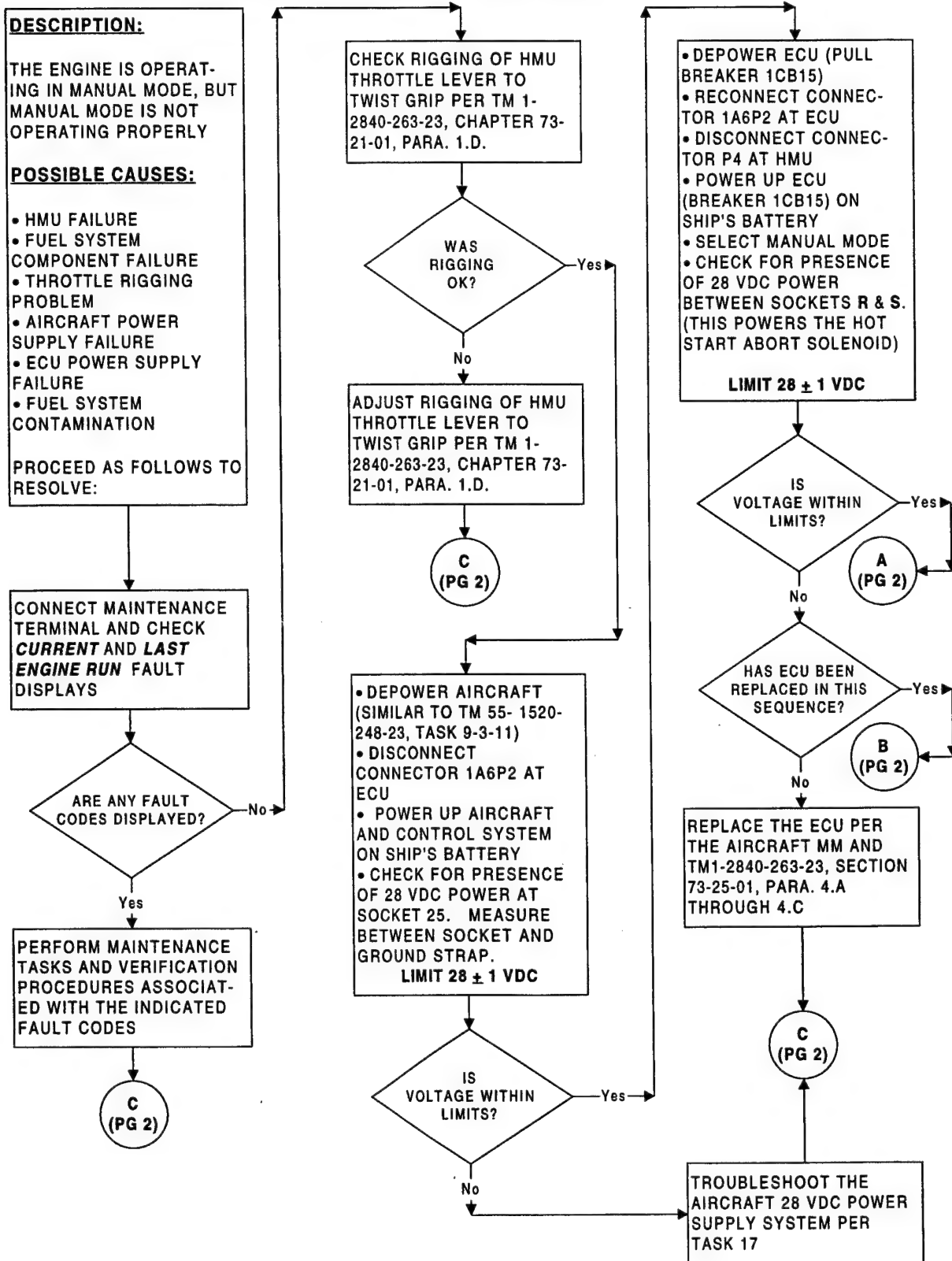
C  
(PG 2)

TROUBLESHOOT THE  
AIRCRAFT 28VDC POWER  
SUPPLY OR THE PMA CIRCUIT  
(PER TASKS 17 OR 11, AS  
APPLICABLE)

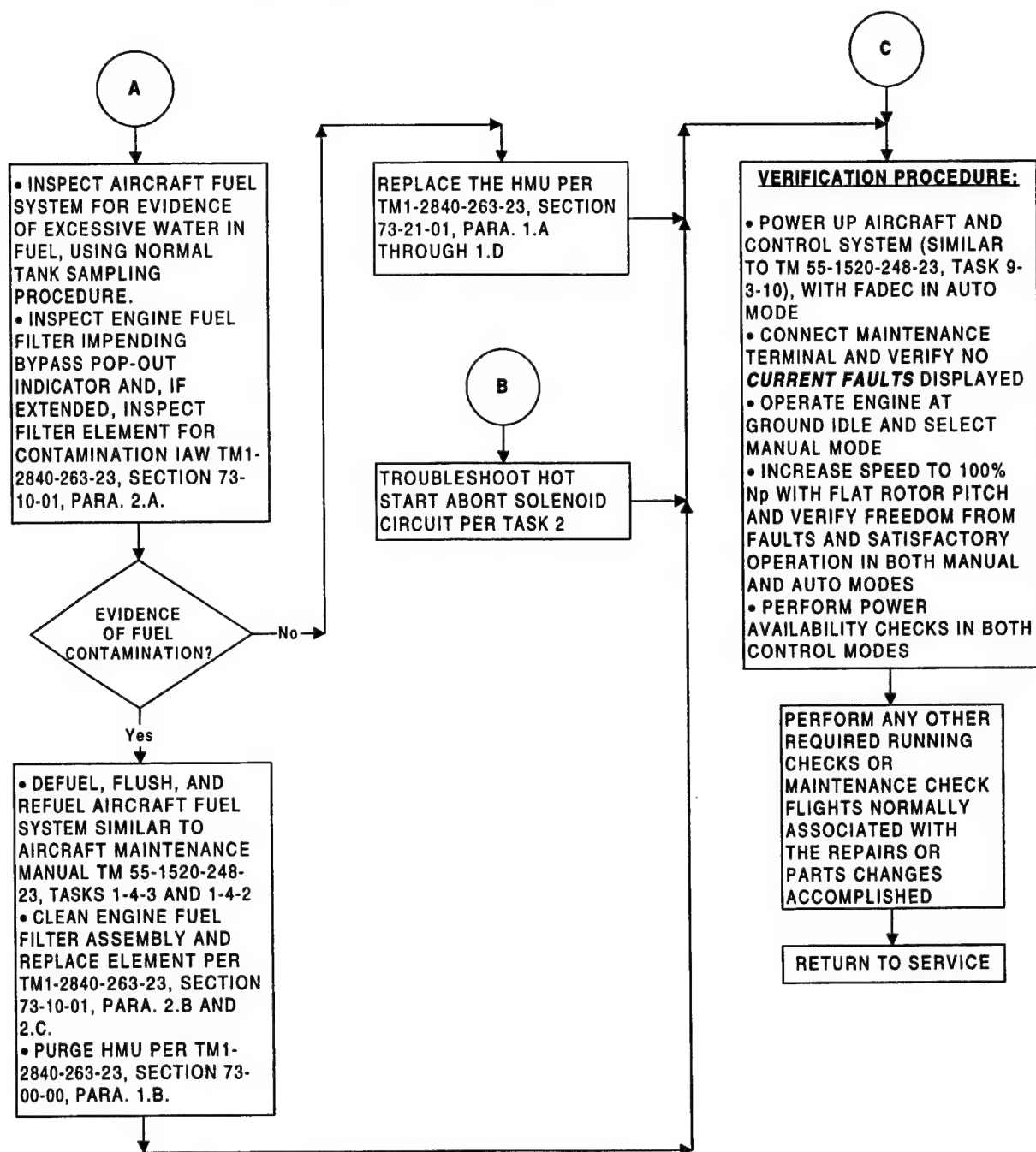
27 AUG 1998



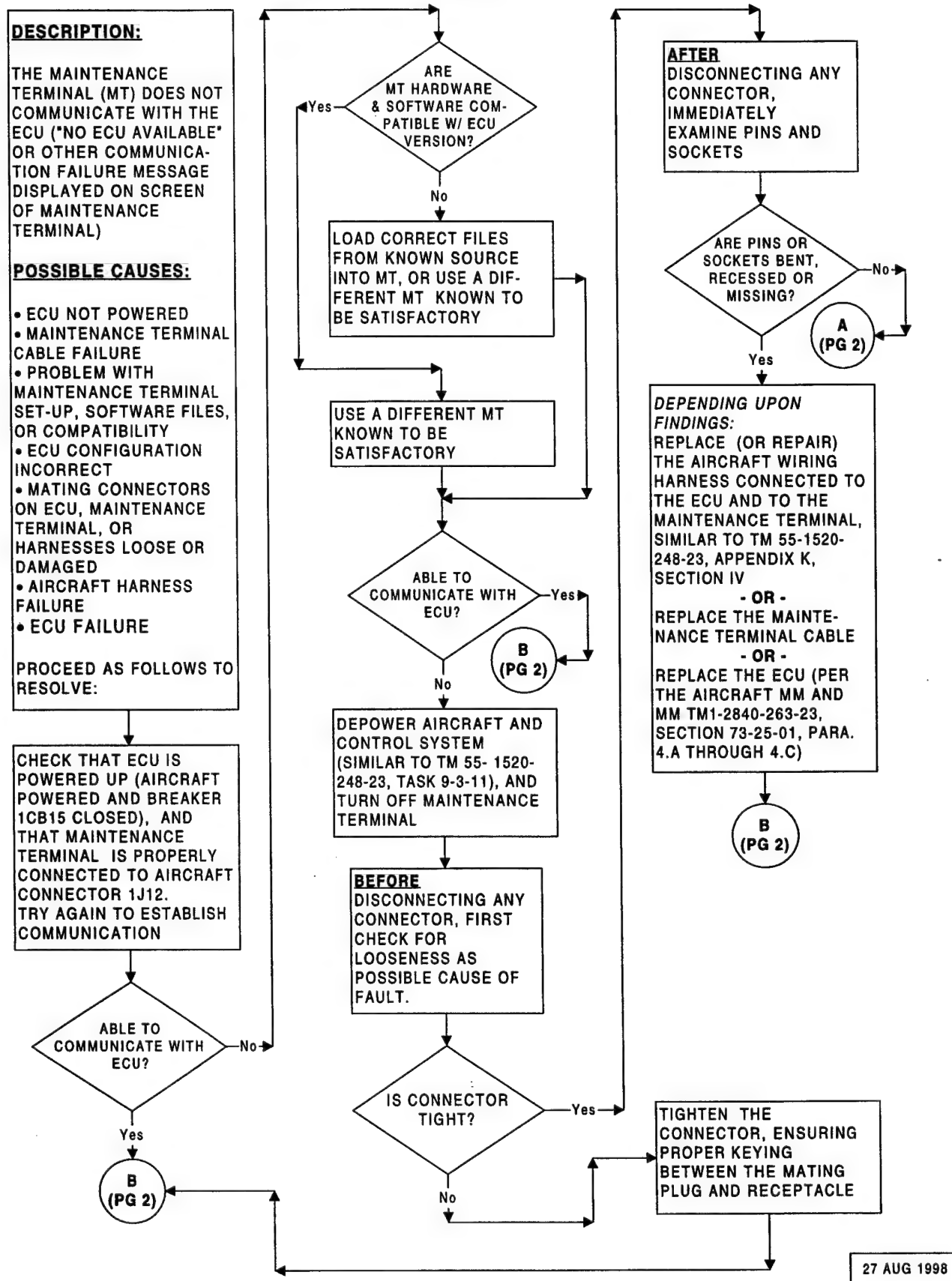
27 AUG 1998

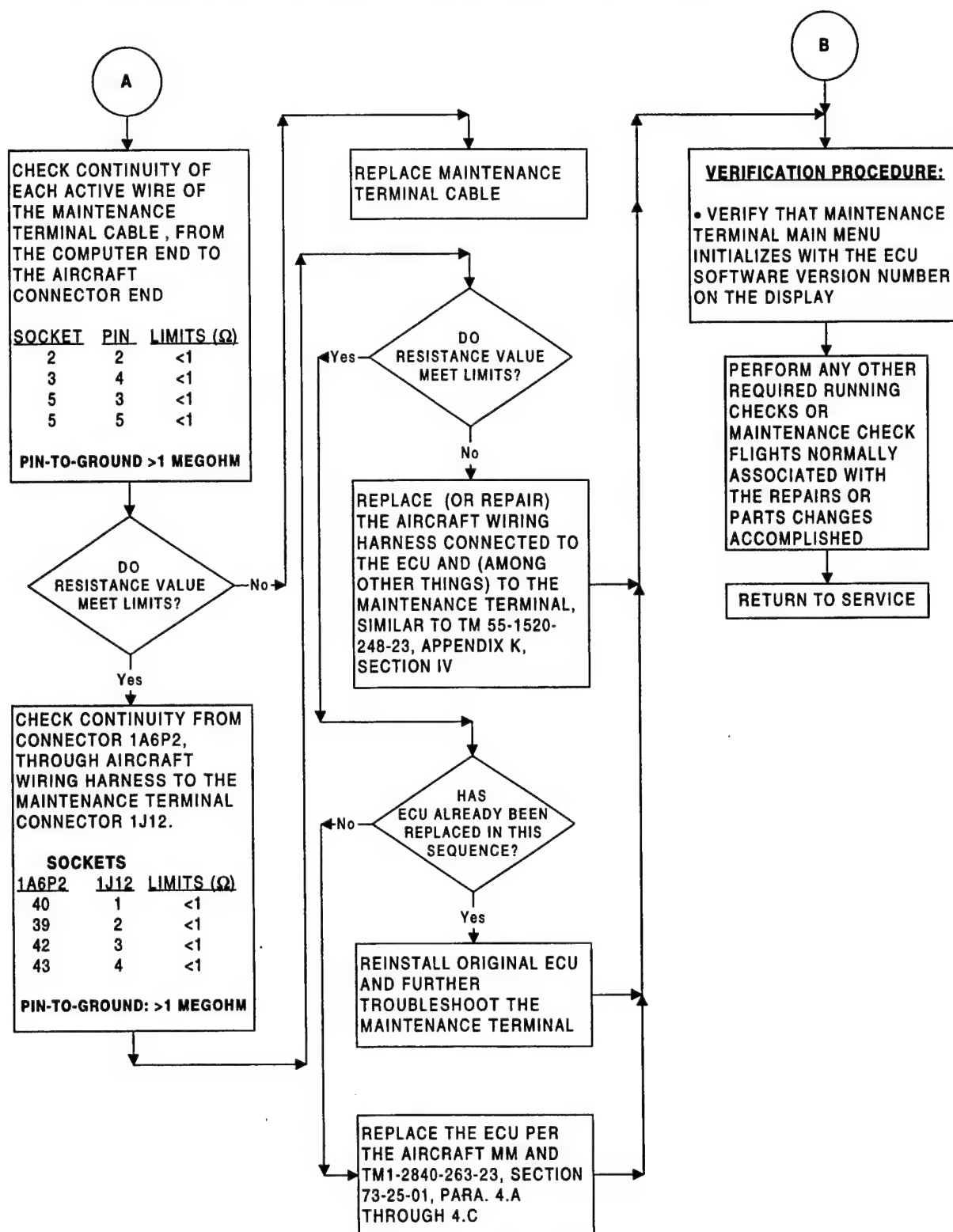


27 AUG 1998



27 AUG 1998





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# 48. **FADEC DEGRADE - DROOP MESSAGE (MFD)** **INCORRECTLY "ON"**

Page 1 of 2

## **ASSOCIATED FAULT INDICATION(S):**

CPFIt, P1FIt, PLA12FIt, PLAR1FIt,  
 SgFlag, StSFIt, StSIFIt, WtLimFlg

## **DESCRIPTION:**

A **FADEC DEGRADE - DROOP** MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

No

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
 (PG 2)

USING MAINTENANCE TERMINAL, CHECK **CURRENT** AND **LAST ENGINE RUN** FAULTS DISPLAY

ANY FAULTS  
 DISPLAYED?

No

Yes

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS  
 CONNECTOR  
 TIGHT?

No

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
 (PG 2)

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR  
 SOCKETS BENT,  
 RECESSED OR  
 MISSING?

Yes

**A**  
 (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

Yes

**B**  
 (PG 2)

No

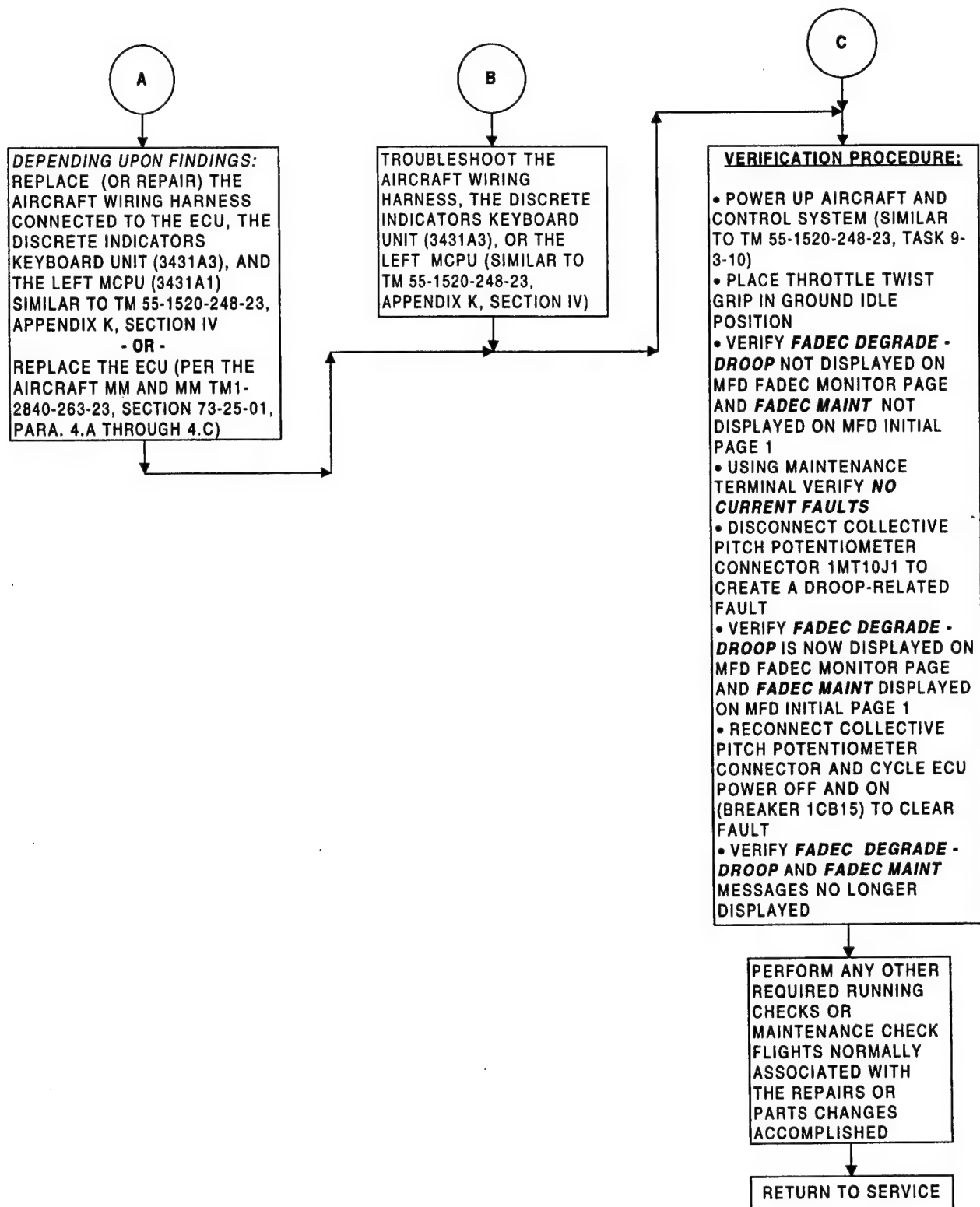
REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

01 SEP 1998



48. FADEC DEGRADE - DROOP MESSAGE (MFD)  
INCORRECTLY "ON"

Page 2 of 2



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# 49. **FADEC DEGRADE - DROOP MESSAGE (MFD)** **INCORRECTLY "OFF"**

Page 1 of 2

## **ASSOCIATED FAULT INDICATION(S):**

CPFit, P1Fit, PLA12Fit, PLARiFit,  
SgFlag, StSFit, StSIFit, WLimFlg

## **DESCRIPTION:**

A **FADEC DEGRADE - DROOP** MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
- CHECK WHETHER **FADEC MAINT ADVISORY** IS DISPLAYED ON MFD
- USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN FAULTS** DISPLAYS

DEPOWER AIRCRAFT  
(SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS  
CONNECTOR  
TIGHT?

Yes

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
(PG 2)

ARE PINS OR  
SOCKETS BENT,  
RECESSED OR  
MISSING?

Yes

**B**  
(PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
- CHECK MFD FOR **FADEC MAINT ADVISORY**

IS  
**FADEC MAINT**  
ADVISORY  
DISPLAYED?

Yes

**A**  
(PG 2)

No

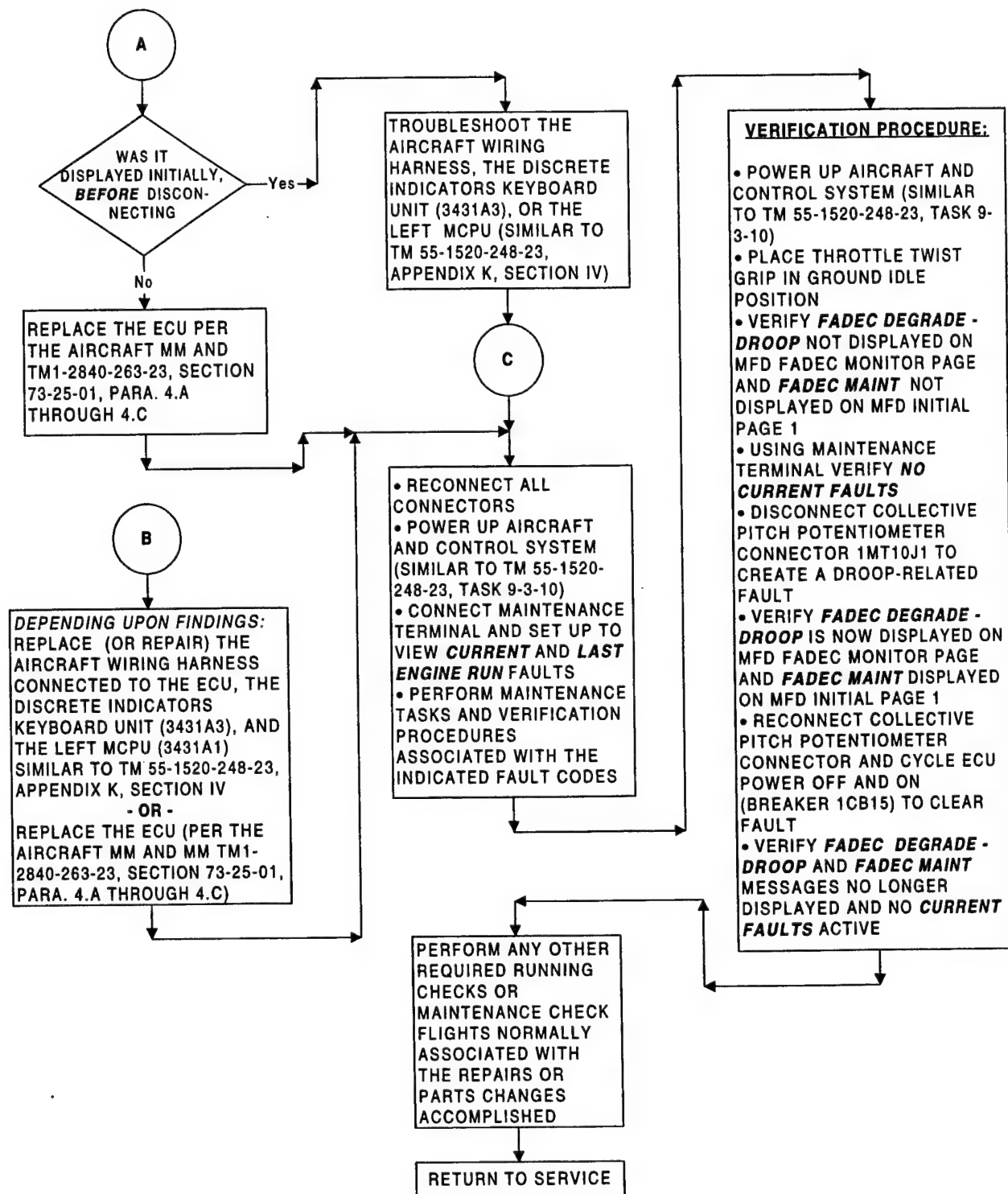
TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
(PG 2)

02 SEP 1998

49. **FADEC DEGRADE - DROOP MESSAGE (MFD)**  
**INCORRECTLY "OFF"**

Page 2 of 2



02 SEP 1998

# 50. **FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD)** **INCORRECTLY "ON"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
 OSVFI, OSFI

## **DESCRIPTION:**

A **FADEC DEGRADE - OS** (OVERSPEED) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

No

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
 (PG 2)

USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN** FAULTS DISPLAY

ANY FAULTS  
 DISPLAYED?

No

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS  
 CONNECTOR  
 TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
 (PG 2)

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

**A**  
 (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

Yes

**B**  
 (PG 2)

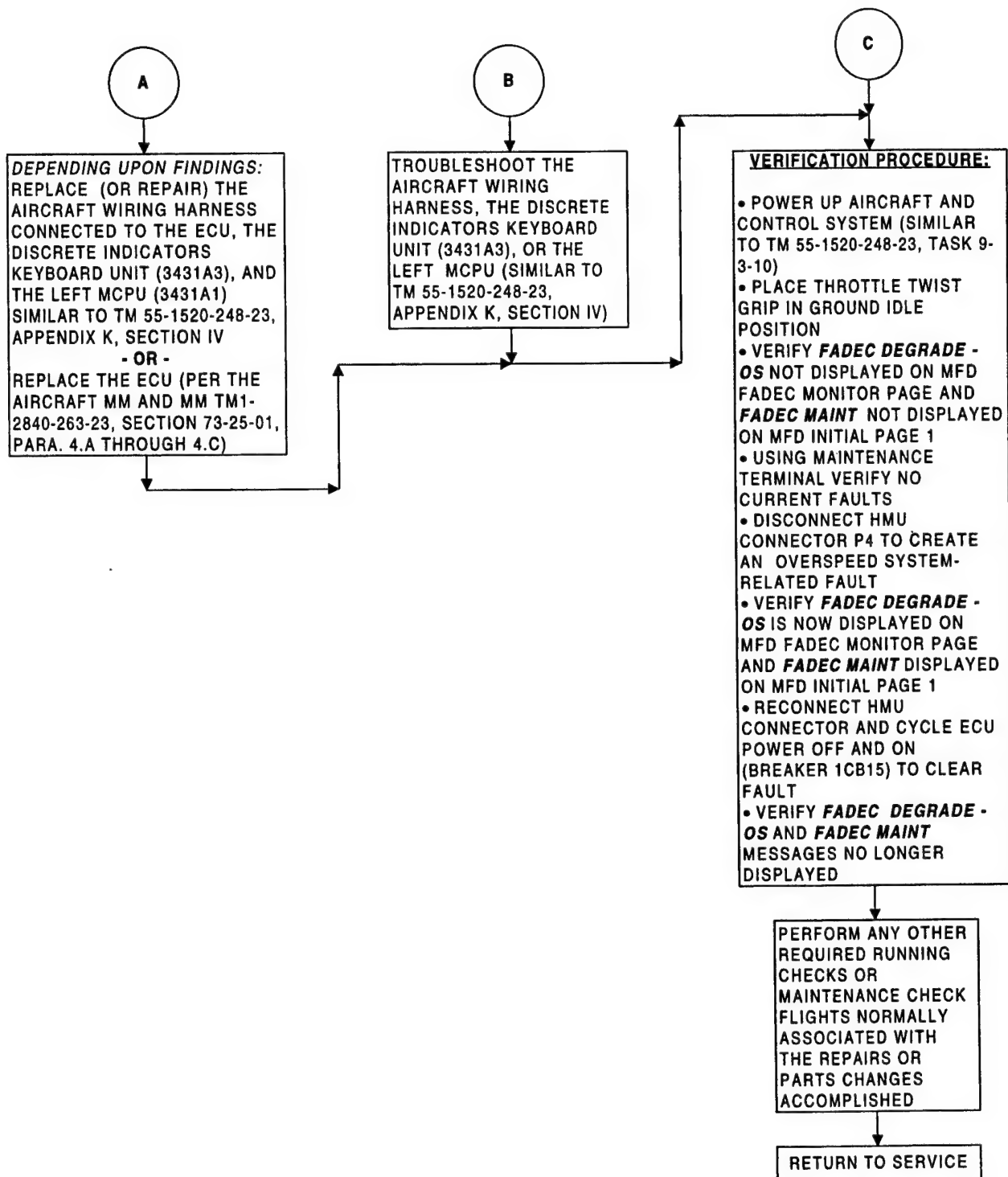
No

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

01 SEP 1998

50. FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD)  
INCORRECTLY "ON"

Page 2 of 2



01 SEP 1998

# 51. **FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD)** **INCORRECTLY "OFF"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
OSVFit, OSFit

## **DESCRIPTION:**

A **FADEC DEGRADE - OS (OVERSPEED)** MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
- CHECK WHETHER **FADEC MAINT ADVISORY** IS DISPLAYED ON MFD
- USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN FAULTS** DISPLAYS

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
- CHECK MFD FOR **FADEC MAINT ADVISORY**

IS **FADEC MAINT ADVISORY** DISPLAYED?

Yes

A (PG 2)

No

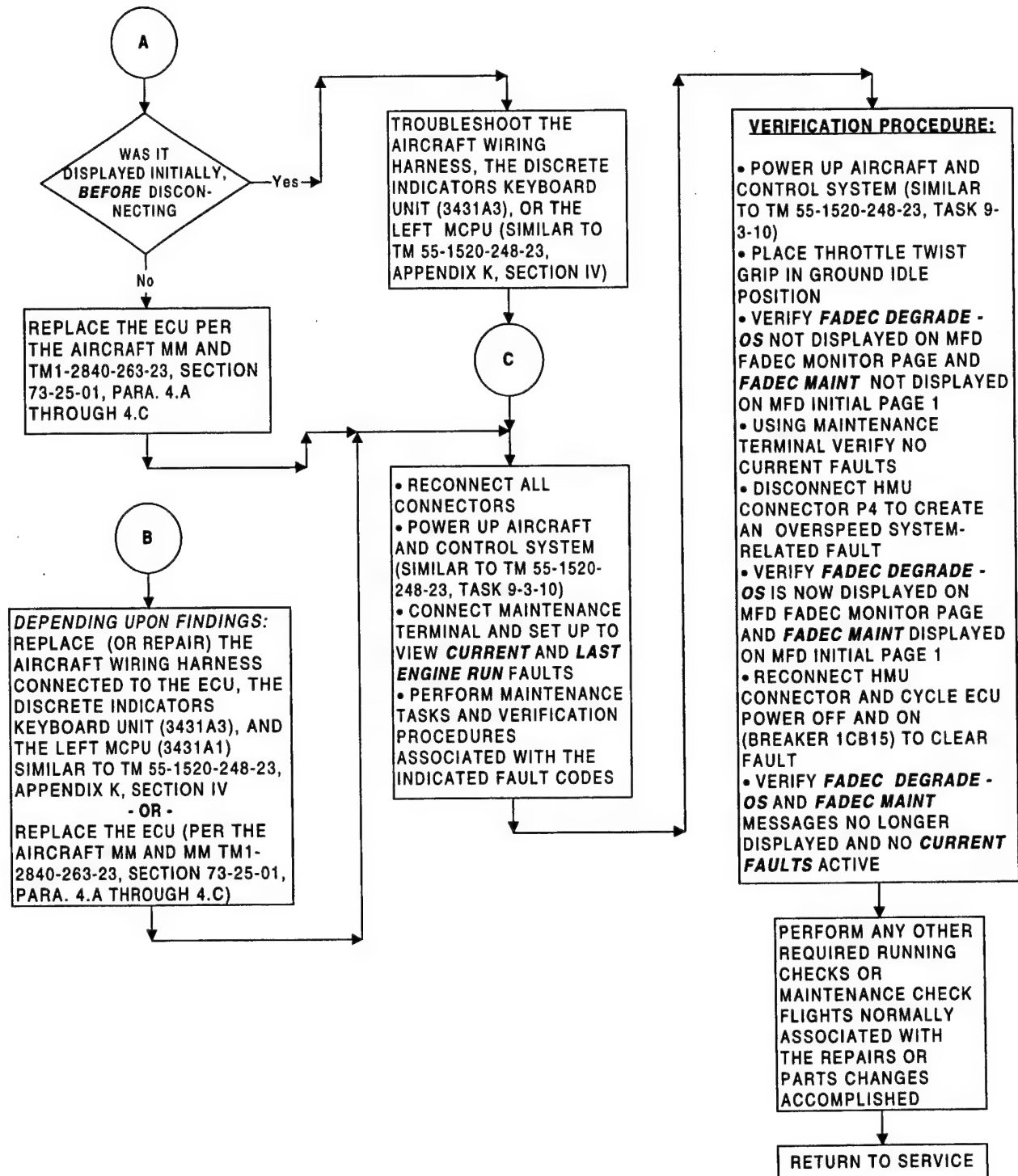
TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

C (PG 2)

02 SEP 1998

51. FADEC DEGRADE - OS (OVERSPEED) MESSAGE (MFD)  
INCORRECTLY "OFF"

Page 2 of 2



02 SEP 1998

## 52. FADEC DEGRADE - ARINC MESSAGE (MFD) INCORRECTLY "ON"

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
ARINCHWFI

### DESCRIPTION:

A **FADEC DEGRADE - ARINC** MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

### POSSIBLE CAUSES:

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS **FADEC MAINT** ADVISORY DISPLAYED?

No

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
(PG 2)

USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN** FAULTS DISPLAY

ANY FAULTS DISPLAYED?

No

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
(PG 2)

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

**A**  
(PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS **FADEC MAINT** ADVISORY DISPLAYED?

Yes

**B**  
(PG 2)

No

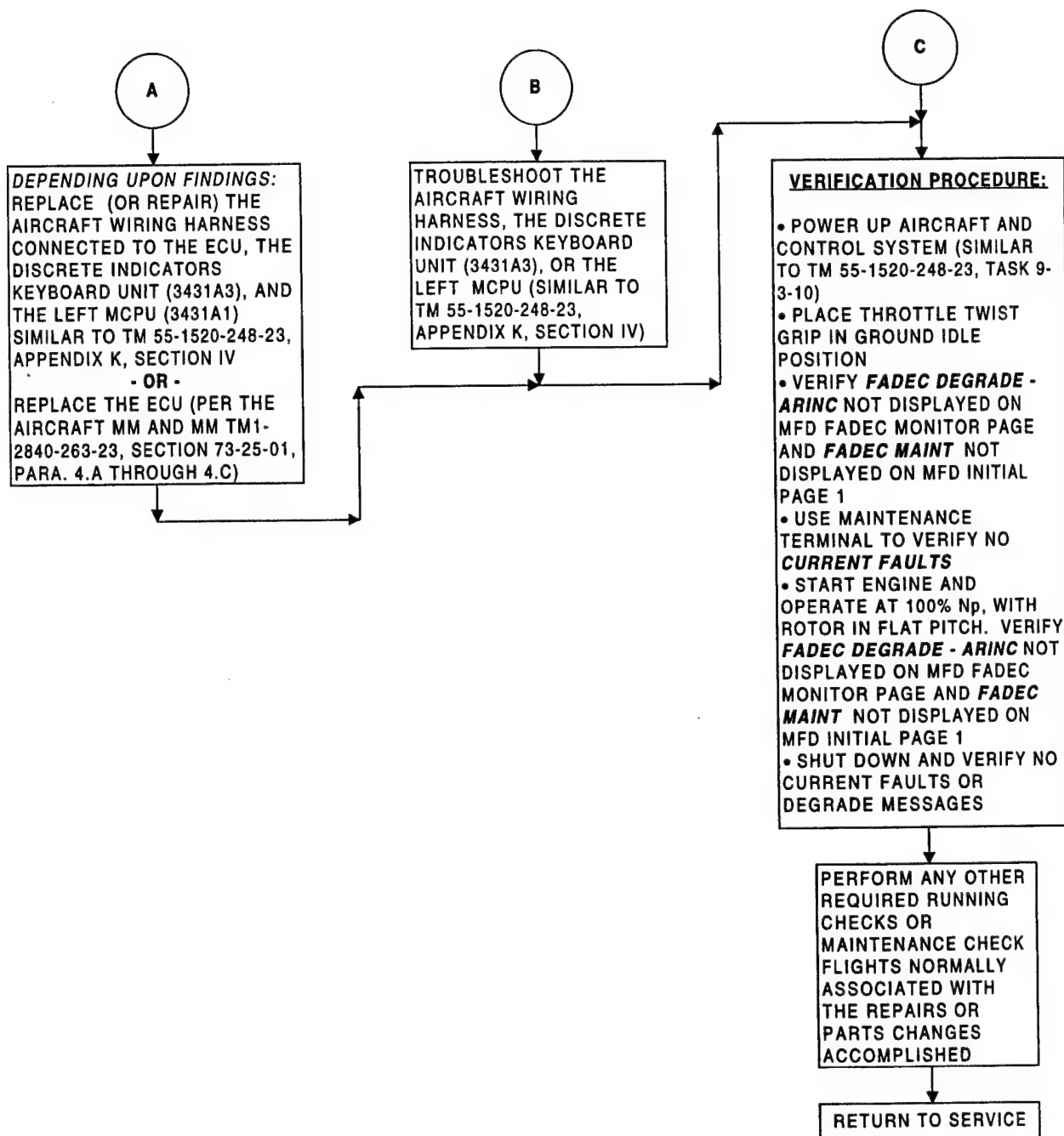
REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

31 AUG 1998



52. FADEC DEGRADE - ARINC MESSAGE (MFD)  
INCORRECTLY "ON"

Page 2 of 2



31 AUG 1998

# 53. **FADEC DEGRADE - ARINC MESSAGE (MFD)** **INCORRECTLY "OFF"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
 ARINCHWDFIT

## **DESCRIPTION:**

A **FADEC DEGRADE - ARINC** MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULT IS ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
- CHECK WHETHER **FADEC MAINT** ADVISORY IS DISPLAYED ON MFD
- USING MAINTENANCE TERMINAL, CHECK **CURRENT** AND **LAST ENGINE RUN FAULTS** DISPLAYS

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C  
 (PG 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B  
 (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
- CHECK MFD FOR **FADEC MAINT** ADVISORY

IS **FADEC MAINT** ADVISORY DISPLAYED?

Yes

A  
 (PG 2)

No

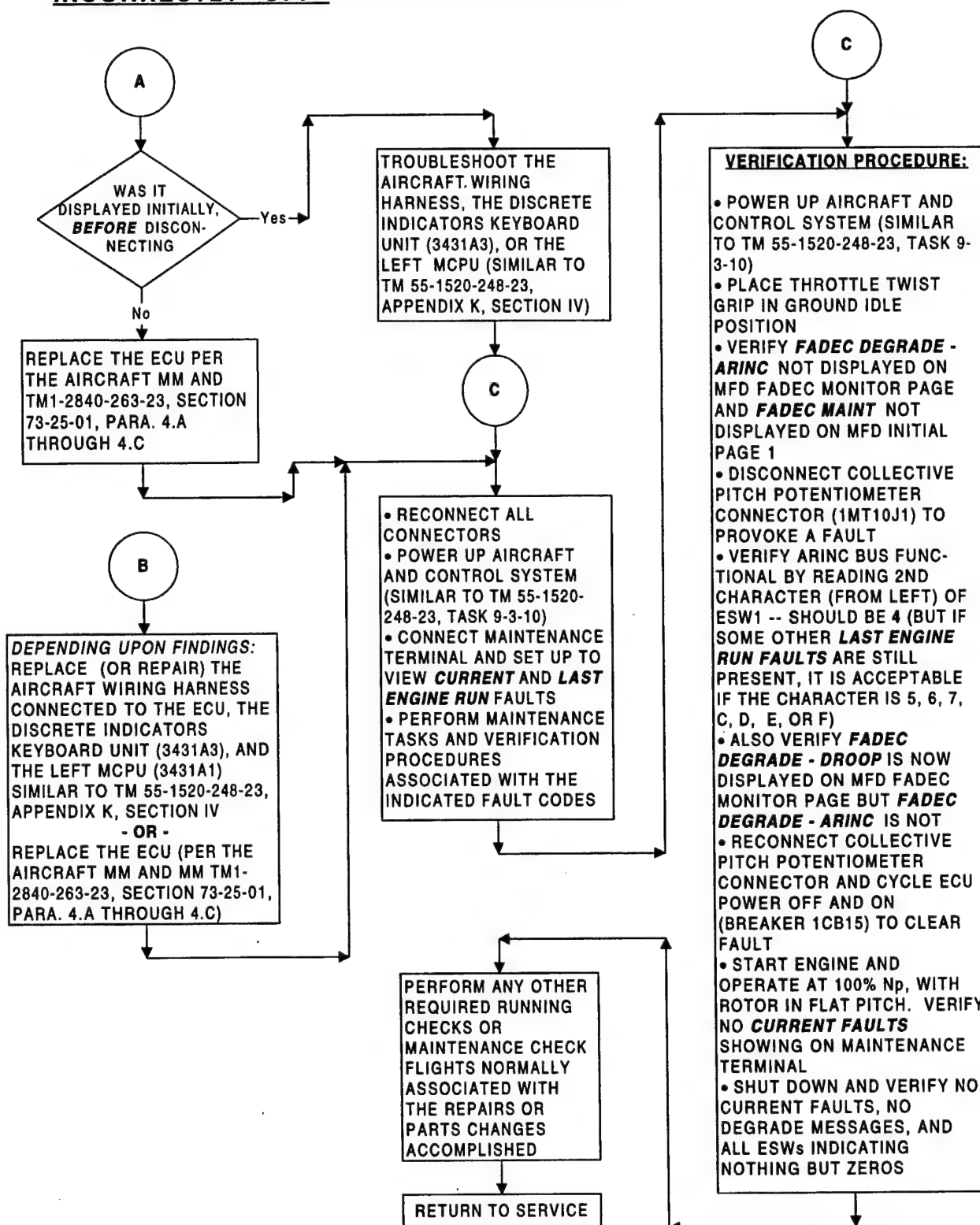
TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

C  
 (PG 2)

02 SEP 1998

53. **FADEC DEGRADE - ARINC MESSAGE (MFD)**  
**INCORRECTLY "OFF"**

Page 2 of 2



02 SEP 1998

REV. 12 JUL 99

# 54. **FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD)** **INCORRECTLY "ON"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
 QFI

## **DESCRIPTION:**

A **FADEC DEGRADE - TRQ LIM LOSS** (TORQUE LIMITER LOSS) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
 (PG 2)

USING MAINTENANCE TERMINAL, CHECK **CURRENT** AND **LAST ENGINE RUN** FAULTS DISPLAY

ANY FAULTS  
 DISPLAYED?

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS  
 CONNECTOR  
 TIGHT?

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
 (PG 2)

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

**A**  
 (PG 2)

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS  
**FADEC MAINT**  
 ADVISORY  
 DISPLAYED?

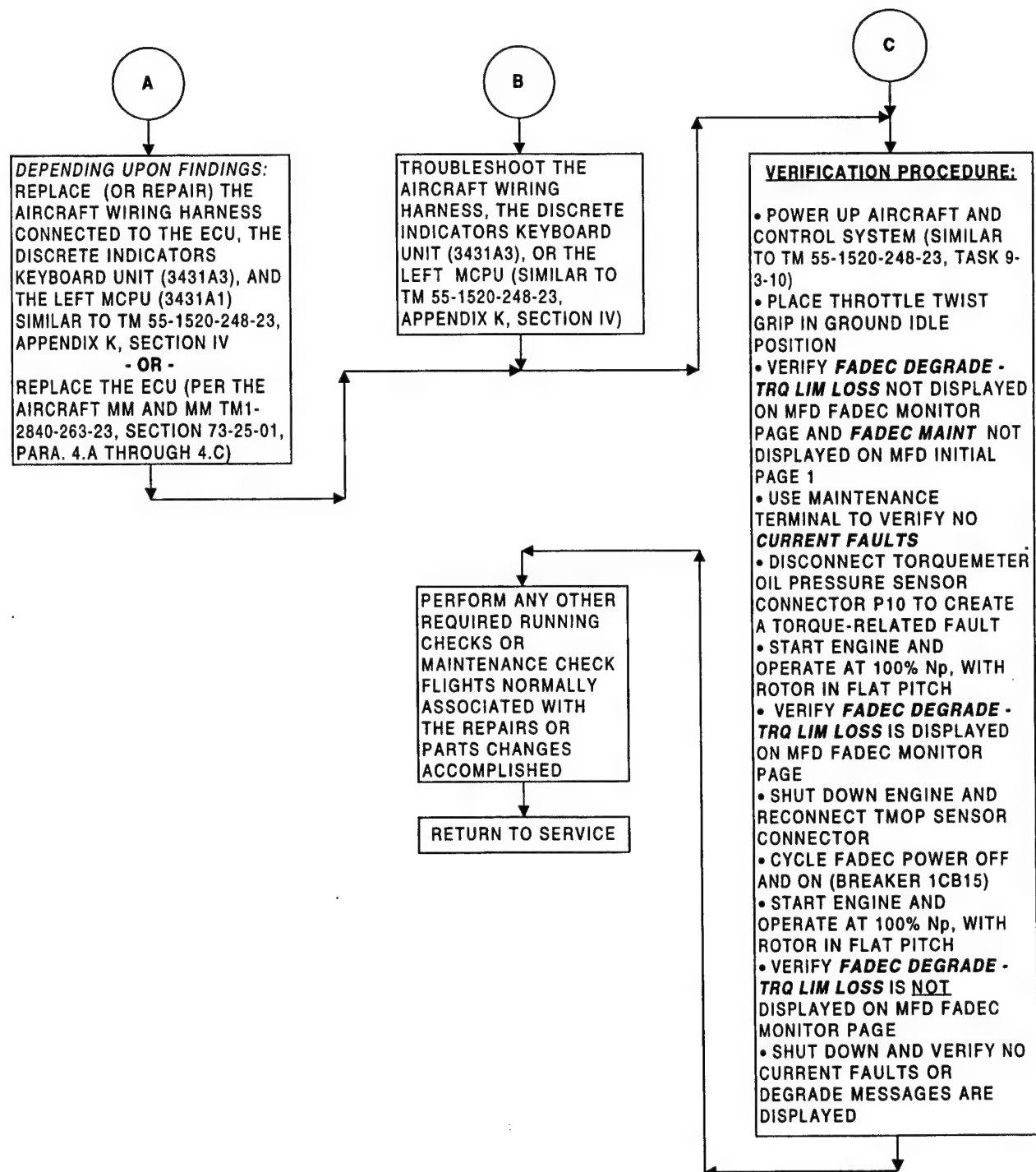
**B**  
 (PG 2)

REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

01 SEP 1998

54. FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD)  
INCORRECTLY "ON"

Page 2 of 2



01 SEP 1998

# 55. **FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD)** **INCORRECTLY "OFF"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
 QFit

## **DESCRIPTION:**

A **FADEC DEGRADE - TRQ LIM LOSS** (TORQUE LIMITER LOSS) MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN ASSOCIATED FAULT IS ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
- CHECK WHETHER **FADEC MAINT ADVISORY** IS DISPLAYED ON MFD
- USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN FAULTS** DISPLAYS

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
 DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

**AFTER**  
 DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C

(PG 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B  
 (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
- CHECK MFD FOR **FADEC MAINT ADVISORY**

IS **FADEC MAINT ADVISORY** DISPLAYED?

Yes

A  
 (PG 2)

No

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

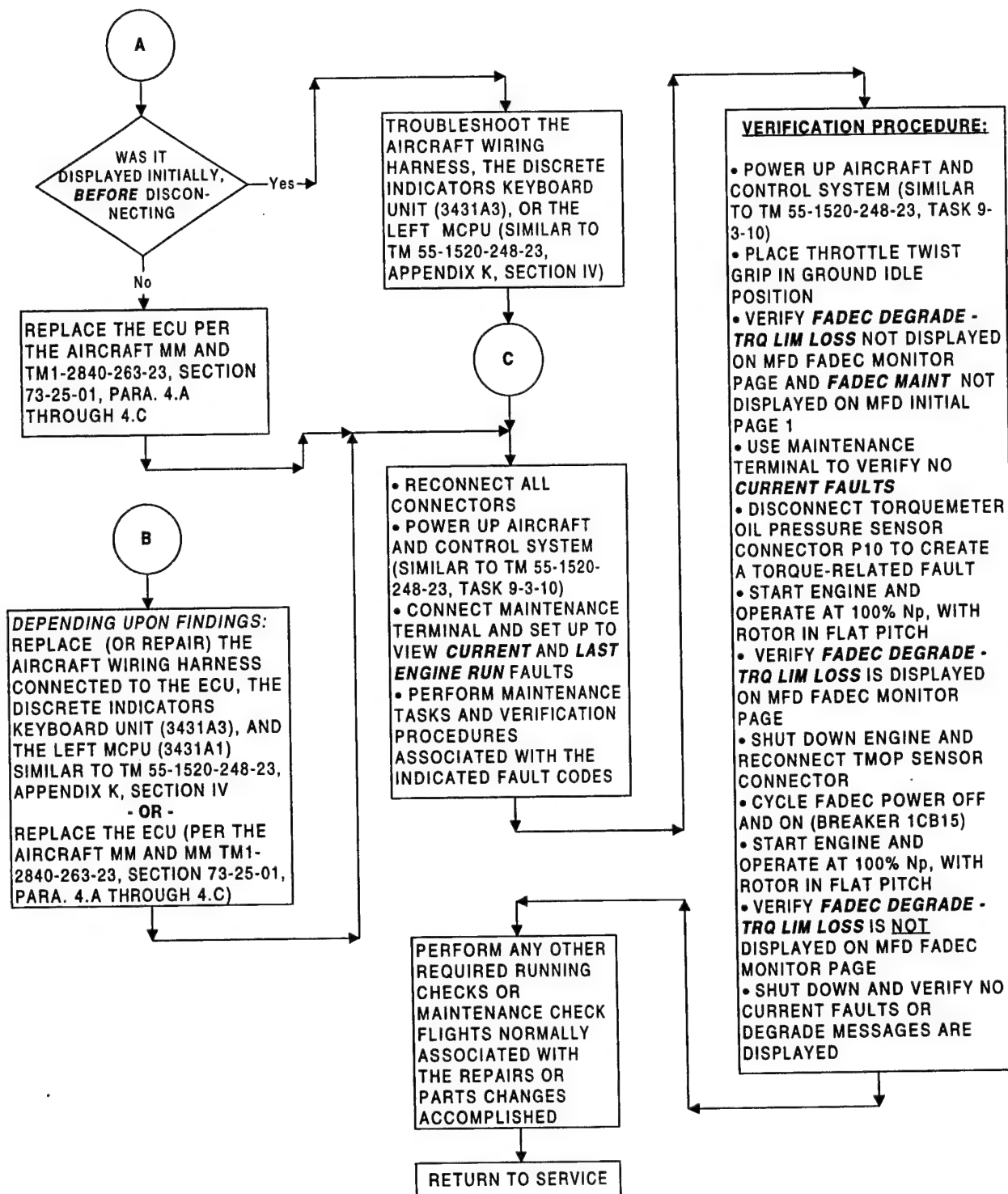
C

(PG 2)

02 SEP 1998

# 55. **FADEC DEGRADE - TRQ LIM LOSS MESSAGE (MFD)** **INCORRECTLY "OFF"**

Page 2 of 2



02 SEP 1998

# 56. **FADEC DEGRADE - TGT (OR MGT) LIM LOSS** **MESSAGE (MFD) INCORRECTLY "ON"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
MGTFH, CJCFH

## **DESCRIPTION:**

A **FADEC DEGRADE - TGT LIM LOSS** (TGT LIMITER LOSS) MESSAGE IS DISPLAYED ON MFD FADEC MONITOR PAGE WHEN NO RELATED FAULTS ARE ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION

IS  
**FADEC MAINT**  
ADVISORY  
DISPLAYED?

No

TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

**C**  
(PG 2)

USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN** FAULTS DISPLAY

ANY FAULTS  
DISPLAYED?

Yes

PERFORM MAINTENANCE TASKS AND VERIFICATION PROCEDURES ASSOCIATED WITH ALL DISPLAYED FAULT CODES

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE**  
DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS  
CONNECTOR  
TIGHT?

Yes

No

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

**C**  
(PG 2)

**AFTER**  
DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

ARE PINS OR  
SOCKETS BENT,  
RECESSED OR  
MISSING?

No

**A**  
(PG 2)

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)

IS  
**FADEC MAINT**  
ADVISORY  
DISPLAYED?

No

**B**  
(PG 2)

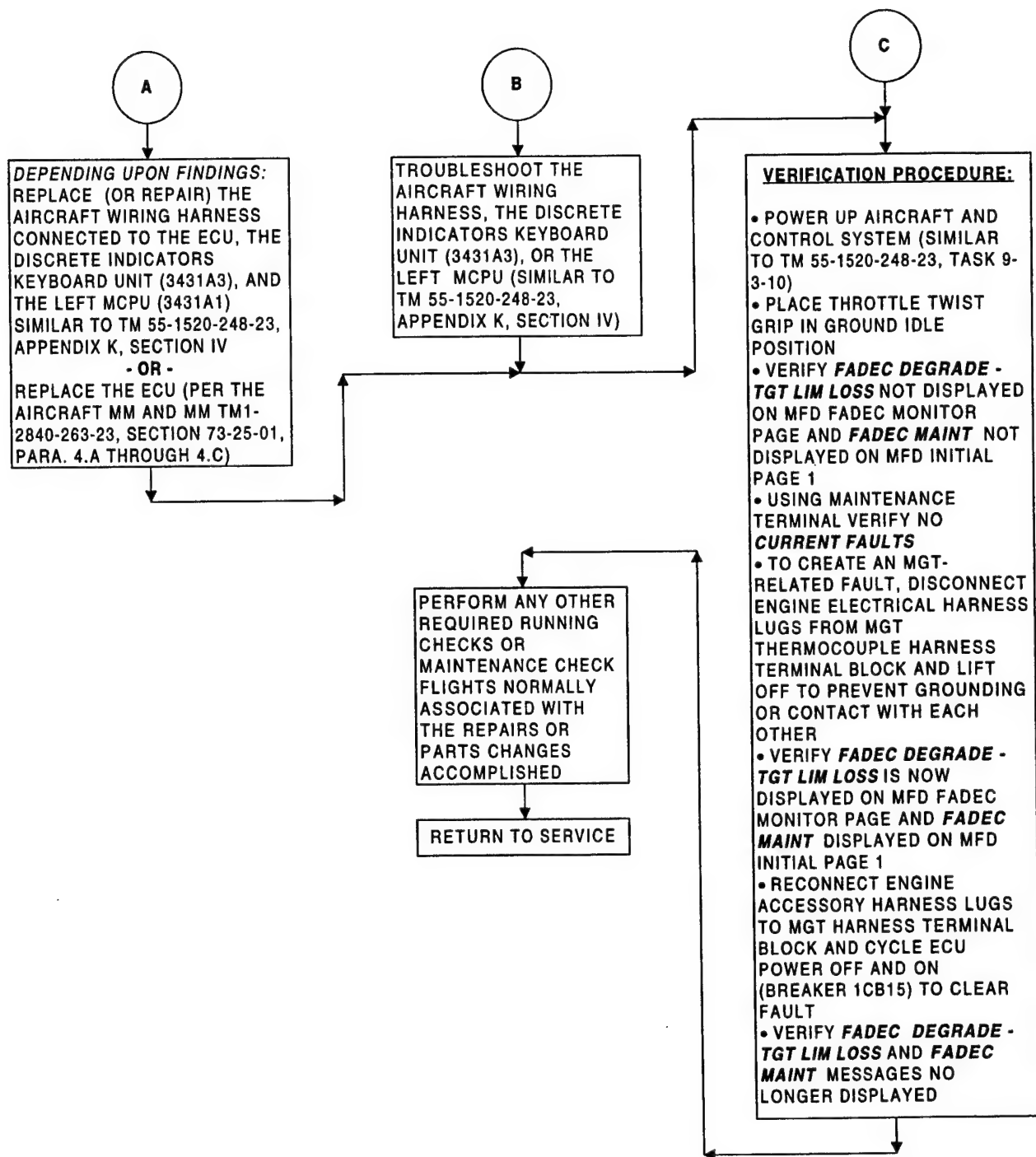
REPLACE THE ECU PER THE AIRCRAFT MM AND TM1-2840-263-23, SECTION 73-25-01, PARA. 4.A THROUGH 4.C

01 SEP 1998



56. **FADEC DEGRADE - TGT (OR MGT) LIM LOSS**  
**MESSAGE (MFD) INCORRECTLY "ON"**

Page 2 of 2



01 SEP 1998

# 57. **FADEC DEGRADE - TGT (OR MGT) LIM LOSS** **MESSAGE (MFD) INCORRECTLY "OFF"**

Page 1 of 2

**ASSOCIATED FAULT INDICATION(S):**  
MGTFit, CJCFit

## **DESCRIPTION:**

A **FADEC DEGRADE - TGT LIM LOSS** (TGT LIMITER LOSS) MESSAGE IS NOT DISPLAYED ON MFD FADEC MONITOR PAGE WHEN AN ASSOCIATED FAULT IS ACTIVE

## **POSSIBLE CAUSES:**

- FAILURE OF AIRCRAFT HARNESS FROM ECU TO DISCRETE INDICATORS KEYBOARD UNIT, KEYBOARD UNIT ITSELF, OR LEFT MCPU
- MATING CONNECTOR AT ECU LOOSE OR DAMAGED
- ECU FAILURE

PROCEED AS FOLLOWS TO RESOLVE:

- POWER UP AIRCRAFT AND CONTROL SYSTEM (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10)
- PLACE THROTTLE TWIST GRIP IN CUTOFF POSITION
- CHECK WHETHER **FADEC MAINT ADVISORY** IS DISPLAYED ON MFD
- USING MAINTENANCE TERMINAL, CHECK **CURRENT AND LAST ENGINE RUN FAULTS** DISPLAYS

DEPOWER AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-11)

**BEFORE** DISCONNECTING ANY CONNECTOR, FIRST CHECK FOR LOOSENESS AS POSSIBLE CAUSE OF FAULT.

IS CONNECTOR TIGHT?

No

Yes

**AFTER** DISCONNECTING ANY CONNECTOR, IMMEDIATELY EXAMINE PINS AND SOCKETS

TIGHTEN THE CONNECTOR, ENSURING PROPER KEYING BETWEEN THE MATING PLUG AND RECEPTACLE

C (PG 2)

ARE PINS OR SOCKETS BENT, RECESSED OR MISSING?

Yes

B (PG 2)

No

- DISCONNECT CONNECTOR 1A6P2 AT ECU
- POWER UP AIRCRAFT (SIMILAR TO TM 55-1520-248-23, TASK 9-3-10), BUT LEAVE ECU POWER OFF (CIRCUIT BREAKER 1CB15 PULLED)
- CONNECT A JUMPER FROM SOCKET 14 TO GROUND AT ECU GROUNDING STRAP
- CHECK MFD FOR **FADEC MAINT ADVISORY**

IS **FADEC MAINT ADVISORY** DISPLAYED?

Yes

A (PG 2)

No

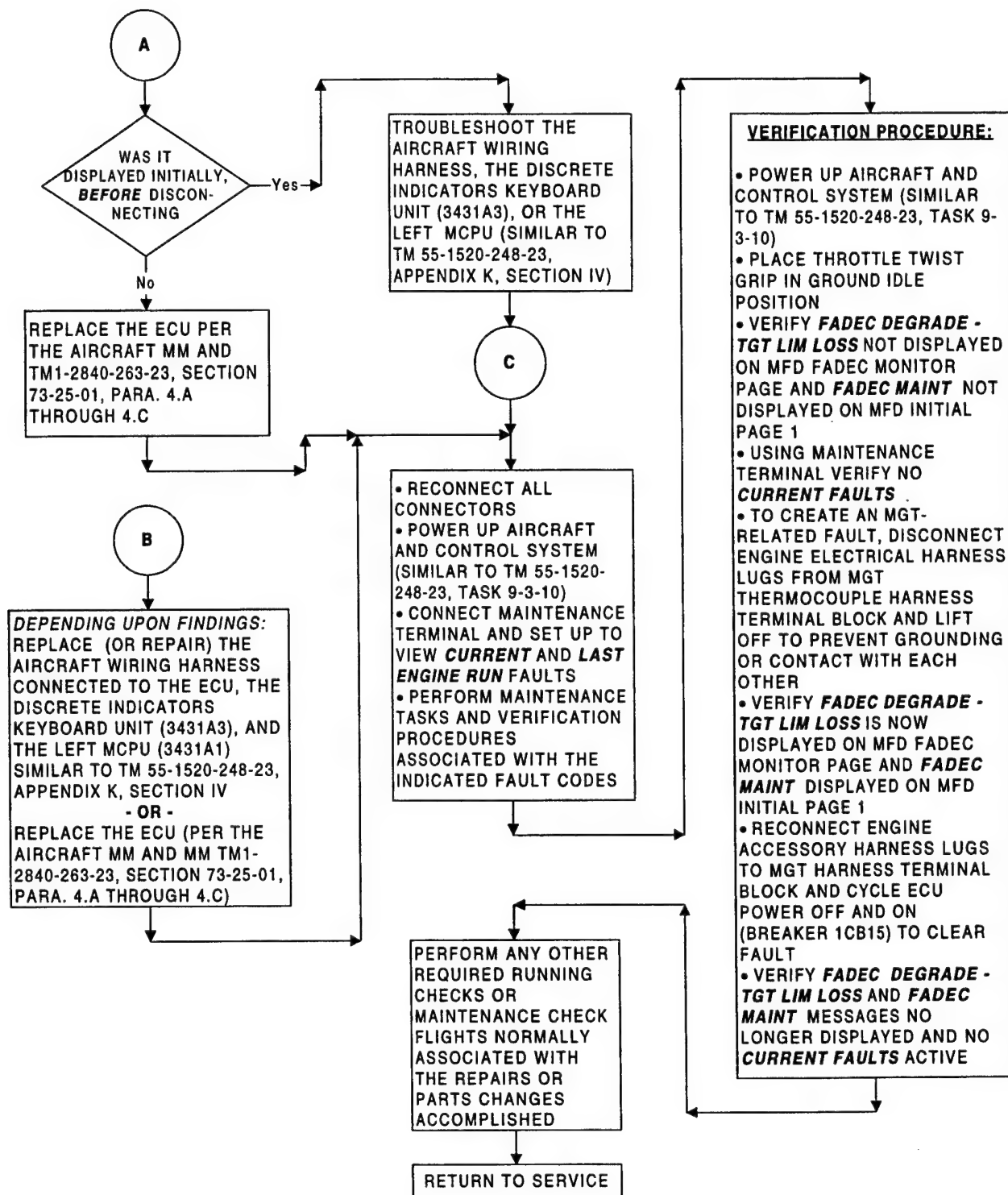
TROUBLESHOOT THE AIRCRAFT WIRING HARNESS, THE DISCRETE INDICATORS KEYBOARD UNIT (3431A3), OR THE LEFT MCPU (SIMILAR TO TM 55-1520-248-23, APPENDIX K, SECTION IV)

C (PG 2)

02 SEP 1998

**57. FADEC DEGRADE - TGT (OR MGT) LIM LOSS  
MESSAGE (MFD) INCORRECTLY "OFF"**

Page 2 of 2



02 SEP 1998

## **Appendix D**

### **Standard Generalized Markup Language (SGML) Tagging**

- Sample SGML Tagged Data File
- Software Considerations for System Implementation

## Appendix D

### Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

```
<!DOCTYPE PROCINFO PUBLIC "-//Grumman//DTD procinfo//EN" (
<!--ArborText, Inc., 1988-1993, v.4001-->
)>
<procinfo><task id="J-7000--3000028970" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW
START SUBTASK 1"
type="N" itemid="15-SEP-98" version="J-VERSION--3000026679" status="ver"
valtype="a" servicedes="A"><text id="J-7000--3000028971" name="GROUND IDLE SPEED TOO
HIGH OR TOO LOW START SUBTASK 1">
GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 1</text>
<step id="J-7200--6000004725" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000003811">Inspect HMU control rigging IAW
TMI-2840-263-23, 73-21-01, para 1.D. and adjust as required IAW (similar to)
TM 55-1540-248-23, Task 4-6-1.</text>
<dialog id="J-7000--3000029047" itemid="15-SEP-98" agent="human">
<menu id="J-7000--3000029050"><prompt id="J-7000--3000029051"><text itemid="14-SEP-98"
ref="J-TEXT--6000004091">Was re-rigging necessary?</text></prompt>
<choice id="J-7000--3000029056">
<link id="J-7000--3000029057" linkends="None">Continue
</link><text itemid="26-AUG-98" ref="J-TEXT--3000026520">Yes</text></choice>
<choice id="J-7000--3000029058">
<link id="J-7000--3000029059" linkends="J-7000--3000028972">Task</link><text itemid="26-AUG-98"
ref="J-TEXT--3000026521">No</text></choice></menu></dialog></step>
<step id="J-7200--6000004727" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000003907">Perform a start to Ground Idle
twist grip position and determine if Ng is within required speed band.</text>
<dialog id="J-7000--3000029063" itemid="15-SEP-98" agent="human">
<menu id="J-7000--3000029066"><prompt id="J-7000--3000029067"><text itemid="14-SEP-98"
ref="J-TEXT--6000003832">Is Ground Idle Ng OK?</text></prompt>
<choice id="J-7000--3000029070">
<link id="J-7000--3000029071" linkends="None">Continue
</link><text itemid="26-AUG-98" ref="J-TEXT--3000026520">Yes</text></choice>
<choice id="J-7000--3000029072">
<link id="J-7000--3000029073" linkends="J-7000--3000028972">Task</link><text itemid="26-AUG-98"
ref="J-TEXT--3000026521">No</text></choice></menu></dialog></step>
<step id="J-7200--6000004729" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000000606">Return to service</text></step>
</task></procinfo>
```

## Appendix D

### Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

```
<!DOCTYPE PROCINFO PUBLIC "-//Grumman//DTD procinfo//EN" (
<!--ArborText, Inc., 1988-1993, v.4001-->
)>
<procinfo><task id="J-7000--3000028972" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW
START SUBTASK 2"
type="N" itemid="15-SEP-98" version="J-VERSION--3000026679" status="ver"
valtype="a" servicedes="A"><text id="J-7000--3000028973" name="GROUND IDLE SPEED TOO
HIGH OR TOO LOW START SUBTASK 2">
GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 2</text>
<step id="J-7200--6000004730" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000004029">Select Real Time Analog Data
display page on Maintenance Terminal.</text></step>
<step id="J-7200--6000004731" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000003908">Perform a start to Ground Idle
twist grip position.</text></step>
<step id="J-7200--6000004732" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000003928">Read and compare Ng indication
from cockpit speed indicator and from Maintenance Terminal.</text>
<dialog id="J-7000--3000029425" itemid="15-SEP-98" agent="human">
<menu id="J-7000--3000029426"><prompt id="J-7000--3000029427"><text itemid="14-SEP-98"
ref="J-TEXT--6000003750">Does cockpit Ng agree with Maintenance Terminal?
</text></prompt>
<choice id="J-7000--3000029429">
<link id="J-7000--3000029432" linkends="J-7000--3000028974">Task</link><text itemid="26-AUG-98"
ref="J-TEXT--3000026520">Yes</text></choice>
<choice id="J-7000--3000029435">
<link id="J-7000--3000029438" linkends="None">Continue
</link><text itemid="26-AUG-98" ref="J-TEXT--3000026521">No</text></choice>
</menu></dialog></step>
<step id="J-7200--6000004734" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000000599">Replace or repair Multiparameter
Display Ng channel IAW (Similar to TM 55-1520-248-23, Tasks 8-1-5, 8-1-6,
8-1-7, and 8-1-8)</text></step>
<step id="J-7200--6000004735" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000004096">Perform a start to Ground Idle
twist grip position and verify that Ng is within required speed band.</text>
</step>
<step id="J-7200--6000004736" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT--6000000606">Return to service.</text></step>
</task></procinfo>
```

## Appendix D

### Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

```
<!DOCTYPE PROCINFO PUBLIC "-//Grumman//DTD procinfo//EN" (
<!--ArborText, Inc., 1988-1993, v.4001-->
)>
<procinfo><task id="J-7000—3000028974" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW
START SUBTASK 3"
type="N" itemid="15-SEP-98" version="J-VERSION—3000026679" status="ver"
valtype="a" servicedes="A"><text id="J-7000—3000028975" name="GROUND IDLE SPEED TOO
HIGH OR TOO LOW START SUBTASK 3">
GROUND IDLE SPEED TOO HIGH OR TOO LOW START SUBTASK 3</text>
<step id="J-7200—6000004737" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION—0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT—6000003953">Remove and replace ECU IAW (similar
to) TM 55-1520-248-23, Tasks 9-7-2* and 9-7-3.</text></step>
<step id="J-7200—6000004738" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION—0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT—6000003905">Perform a start and determine
whether Ng is within required speed band</text>
<dialog id="J-7000—3000029456" itemid="15-SEP-98" agent="human">
<menu id="J-7000—3000029457"><prompt id="J-7000—3000029458"><text itemid="14-SEP-98"
ref="J-TEXT—6000003832">Is Ground Idle Ng OK?</text></prompt>
<choice id="J-7000—3000029462">
<link id="J-7000—3000029465" linkends="J-7000—3000027300">Task</link><text itemid="26-AUG-98"
ref="J-TEXT—3000026520">Yes</text></choice>
<choice id="J-7000—3000029475">
<link id="J-7000—3000029476" linkends="None">Continue
</link><text itemid="26-AUG-98" ref="J-TEXT—3000026521">No</text></choice>
</menu></dialog></step>
<step id="J-7200—6000004740" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION—0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT—6000000495">Remove and replace HMU IAW TMI-2840-263-23,
73-21-01, para 1.A. and 1.B.</text></step>
<step id="J-7200—6000004741" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION—0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT—6000003906">Perform a start and verify that
Ng is within required speed band.</text></step>
<step id="J-7200—6000004742" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION—0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT—6000000606">Return to service</text></step>
</task></procinfo>

<!DOCTYPE PROCINFO PUBLIC "-//Grumman//DTD procinfo//EN" (
<!--ArborText, Inc., 1988-1993, v.4001-->
)>
<procinfo><task id="J-7000—3000028945" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW
START"
type="N" itemid="15-SEP-98" version="J-VERSION—3000026679" status="ver"
valtype="a" servicedes="A">
<link id="J-7000—3000031876" linkends="T703">Partinfo
```

## Appendix D

### Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

</link><text id="J-7000--3000028955" name="GROUND IDLE SPEED TOO HIGH OR TOO LOW START">  
GROUND IDLE SPEED TOO HIGH OR TOO LOW START</text>  
<step id="J-7200--6000004714" name="\*\*\*300\*\*R6 GROUND IDLE SPEED TOO HIGH:X00720001\_HGOMAR6"  
itemid="08-OCT-98" cdm="node" version="J-VERSION--3000026679" status="ver" esttime="2.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003770">Ground Idle gas generator speed (Ng) is NOT adjustable, nor is there a speed modulation range below Ground Idle.</text></step>  
<step id="J-7200--6000004715" name="\*\*\*300\*\*R6 GROUND IDLE SPEED TOO HIGH:X00720001\_HGOMAR6"  
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003803">If the throttle lever angle on the HMU is between 12 and 40 degrees, Ng must be 64% + TBD%. If not within this speed band, maintenance action is required.</text></step>  
<step id="J-7200--6000004716" name="\*\*\*300\*\*R6 GROUND IDLE SPEED TOO HIGH:X00720001\_HGOMAR6"  
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003842">Likely causes of improper Ng at Ground Idle are:</text>  
<table id="J-7000--3000028976" frame="all"><tgroup cols="1" colsep="1" rowsep="1">  
<colspec colwidth="456"><tbody><row><entry valign="middle" align="center">CAUSES OF IMPROPER Ng AT GROUND IDLE</entry>  
</row><row><entry valign="top" align="left">Misrigging of the twist grip to HMU throttle linkage</entry></row><row><entry valign="top" align="left">Cockpit Ng instrumentation error</entry></row><row><entry valign="top" align="left">HMU</entry></row><row><entry valign="top" align="left">ECU</entry></row></tbody></tgroup></table></step>  
<step id="J-7200--6000004721" name="\*\*\*300\*\*R6 GROUND IDLE SPEED TOO HIGH:X00720001\_HGOMAR6"  
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003785">If an out-of-limits Ground Idle Ng condition is encountered, connect Maintenance Terminal and determine whether FADEC faults are indicated. If so, perform maintenance actions as required to clear.</text>  
<dialog id="J-7000--3000028995" itemid="15-SEP-98" agent="human">  
<menu id="J-7000--3000028996"><prompt id="J-7000--3000028997"><text itemid="14-SEP-98" ref="J-TEXT--6000000718">Was the ECU or HMU replaced?</text></prompt>  
<choice id="J-7000--3000029006">  
<link id="J-7000--3000029007" linkends="None">Continue  
</link><text itemid="26-AUG-98" ref="J-TEXT--3000026520">Yes</text></choice>  
<choice id="J-7000--3000029010">  
<link id="J-7000--3000029012" linkends="J-7000--3000028970">Task</link><text itemid="26-AUG-98" ref="J-TEXT--3000026521">No</text></choice></menu></dialog></step>  
<step id="J-7200--6000004722" name="\*\*\*300\*\*R6 GROUND IDLE SPEED TOO HIGH:X00720001\_HGOMAR6"  
cdm="node" version="J-VERSION--0000000014" status="ver" esttime="0.0"><text itemid="14-SEP-98" ref="J-TEXT--6000003907">Perform a start to Ground Idle twist grip position and determine if Ng is within required speed band.</text>  
<dialog id="J-7000--3000029032" itemid="15-SEP-98" agent="human">  
<menu id="J-7000--3000029033"><prompt id="J-7000--3000029034"><text itemid="14-SEP-98" ref="J-TEXT--6000003832">Is Ground Idle Ng OK?</text></prompt>  
<choice id="J-7000--3000029035">



## Appendix D

### Alphanumeric Text of Typical SGML-Tagged Fault Correction Procedure (250-C30R/3 Basic Engine Procedure R-6 - Ground Idle Speed Too High or Too Low)

```
<link id="J-7000---3000029036" linkends="None">Continue
</link><text itemid="26-AUG-98" ref="J-TEXT---3000026520">Yes</text></choice>
<choice id="J-7000---3000029037">
<link id="J-7000---3000029038" linkends="J-7000---3000028970">Task</link><text itemid="26-AUG-98"
ref="J-TEXT---3000026521">No</text></choice></menu></dialog></step>
<step id="J-7200---6000004724" name="***300**R6 GROUND IDLE SPEED TOO
HIGH:X00720001_HGOMAR6"
cdm="node" version="J-VERSION---0000000014" status="ver" esttime="0.0"><text
itemid="14-SEP-98" ref="J-TEXT---6000000606">Return to service</text></step>
</task></procinfo>
```



## T703 -C30R3 Troubleshooting Data SGML Development

### •Software Overview

•JSTARS Integrated Maintenance Information System (JIMIS) authoring software.

### •JIMIS

- JSTARS is an Air Force Acquisition Program for the next generation AWACS.
- The technical data portion of JIMIS provides maintenance with a level 4 Integrated Electronic Technical Manual (IETM).
- Developed by Northrop Grumman as a piece of an overall maintenance information system.
- Uses Commercial Off The Shelf (COTS) software in conjunction with Northrop Grumman authoring Document Type Definition (DTD) and presentation system software Formatting Output Specification Instance (FOSI).
  - Oracle database
  - Adept Publishing (SGML tagging)
  - Intercap Metalink for graphics



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## T703 -C30R3 Troubleshooting Data SGML Development

- SGML Data Types
  - The JIMIS IETM authoring and presentation software contains many different types of data for use in aircraft maintenance. In addition to the types listed below JIMIS includes parts information, graphics, reference material, tools, support equipment and more. Due to the scope of this project only the following have been used:
  - Tasks
    - Contains all the other data types
  - Steps
    - Contain text and dialogs (graphics if used)
  - Text
    - Authored once used many times (cuts down size of database)
  - Dialogs
    - Present choices which will determine what will be seen next, are made up of the following data types:
      - Menu - Presents viewer with a question or selection
      - Prompt - Question or selection criteria
      - Choice - Displays possible answer or choice
      - Links - Three types Task, Dialog, Continue. Task provides avenue to next path, Dialog if additional questions are required, Continue if additional steps are required in current troubleshooting path.



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## T703 -C30R3 Troubleshooting Data SGML Development

### - TASK CONSTRUCTION

#### Task - STARTER WILL NOT MOTOR ENGINE

##### Step - ID# 300001000

Text - ID# 300001001

#### Check electrical connections on starter

##### Dialog - ID# 300001002

Menu - ID# 300001003

Prompt - ID # 300001004

Text - ID # 300001005

#### Are connections secure?

Choice - ID # 300001006

Link - ID # 300001007

Text - ID # 300001008

Yes

Choice - ID # 300001009

Link - ID # 300001010

Text - ID # 30000100011

No



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## T703 -C30R3 Troubleshooting Data SGML Development

- Task Development
  - Source data in the form Visio troubleshooting charts.
  - Copied text from charts into Excel, exported into a database then ran through a filter.
  - Filter creates pseudo tasks (assigns step and text tags with ID numbers). Filter creates one pseudo task for each troubleshooting chart.
  - Used pseudo task to build tasks (multiple tasks created to facilitate multiple troubleshooting paths).
  - Created dialog and linking information (links used to join dialogs and tasks together).
  - Created information in authoring in order to allow display in presentation (FOSI).
  - Performed Quality Check to insure tasks matched each path of the troubleshooting charts.



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## T703 -C30R3 Troubleshooting Data SGML Development

- **DTD:** (Document Type Definition) A DTD is the formal definition of the elements, structures, and rules for marking up a given type of SGML document. You can store a DTD at the beginning of the document or externally in a separate file.
- **FOSI:** (Formatting Output Specification Instance) A FOSI is used for formatting SGML documents for printing and other outputs. It is a separate file that contains formatting information for each element in a document.



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**Appendix E**  
**Test Equipment Required to Perform**  
**Troubleshooting/Diagnostic Tasks**

## **SPECIAL TEST EQUIPMENT REQUIRED TO PERFORM MAINTENANCE TASKS**

1. **Thermocouple Simulator/Calibrator**, such as OMEGA Model CL-300-1000C-K or equivalent, for measured gas temperature
2. **Pressure Transducer and Readout**, 0 - 150 psig, for main oil pressure and torque sensor pressure (accuracy  $\pm 1.0\%$  of full scale).
3. **FADEC Maintenance Terminal** -- a laptop PC with specialized software, that communicates with the FADEC through the aircraft mounted FADEC test port. This could be the same PC used by the mechanic to maintain the engine.
4. **Electrical Connectors, with stub wires attached to all active pins or sockets**, to mate to the following engine and aircraft connectors (ref. Rolls-Royce Allison Electrical Installation Connection Diagram), for use in performing electrical continuity and resistance checks of electrical and electronic components: 1A6P1, 1A6P2, 1A8J1, 1A9J1, 1J12, 1MT10P1, 1P2, 1P3, 1P10, 4A2J1, J4, J7, J10, J11, AND P6.
5. **Frequency Generator**, to simulate signals from Ng and Np speed pick-ups. Requirements: frequency 2 Khz to 20 Khz, input impedance 100W to 150W.
6. **Volt-Ohm Meter**, for use in performing electrical continuity and resistance checks of electrical and electronic components, particularly as related to the FADEC. Requirements: voltage - accuracy of  $\pm 0.1\%$  of full scale on 200 volt range; resistance - accuracy of  $\pm 0.05\%$  of full scale on 200 ohm range,  $\pm 0.5\%$  all other ranges, able to measure 50 milliohms within  $\pm 5$  milliohms using a 4-wire configuration, must not supply more than 5 milliamperes when measuring potentiometer resistances as excess current may cause damage.

These items of equipment could be configured as individual modules or integrated into a single unit



## Applicability to Fault Correction Procedures

### T703-AD-700 ENGINE

FAULT ITEM NO.*	TEST EQUIPMENT ITEM NO.**
ST-5	1
ST-6	1
RG-4	5
RG-5	5
RG-6	5
RGF-5	5
RGF-12	2
RGF-13	2
RGF-14	2
RGF-15	2
RGF-16	2
RF-1	1, 2, 5
RF-3	1

### 250-C30R/3 BASIC ENGINE

FAULT ITEM NO.*	TEST EQUIPMENT ITEM NO.**	FAULT ITEM NO.*	TEST EQUIPMENT ITEM NO.**
ST-2	3	R-10	3, 5
ST-3	3	R-13	2
ST-4	3	R-14	2
ST-5	3	R-15	2
ST-6	3	R-16	2
ST-7	3	R-22	1, 3
ST-8	3	R-23	3
ST-9	1, 3, 6	R-24	3
ST-10	2	R-25	2
R-1	6	R-26	2
R-2	3	R-27	2, 3
R-4	3	R-28	3
R-6	3	R-29	3
R-8	1, 3	R-30	2
R-9	3	SD-3	2

### 250-C30R/3 FADEC

FAULT ITEM NO.*	TEST EQUIPMENT ITEM NO.**	FAULT ITEM NO.*	TEST EQUIPMENT ITEM NO.**
1	3, 4, 6	30	3
2	3, 4, 6	31	3, 4, 6
3	3, 4, 6	32	3, 4, 6
4	3, 4, 6	33	3, 4, 6
5	3, 4, 6	34	3, 4, 6
6	3, 4, 6	35	3
7	3, 4, 6	36	3, 4, 6
8	3, 4, 6	37	3
9	3, 4, 6	38	3
10	3, 4, 6	39	3
11	3, 4, 6	40	3
12	3, 4, 6	41	3, 5
13	3, 4, 6	42	3, 4
14	3, 4, 6	43	3
15	3	44	3
16	3	45	3
17	3, 4, 6	46	3
18	3, 4, 6	47	3, 4, 6
19	3, 4, 6	48	3
20	3, 4	49	3
21	3, 4, 6	50	3
22	3	51	3
23	3, 4, 6	52	3
24	3	53	3
25	3	54	3
26	3, 4, 6	55	3, 4
27	3	56	3
28	3	57	3, 4
29	3		

\***FAULT ITEM NO.** REFERS TO MAINTENANCE FAULTS LISTED IN TABLES I, II, AND III

\*\***TEST EQUIPMENT ITEM NO.** REFERS TO ABOVE LIST OF SPECIAL TEST EQUIPMENT